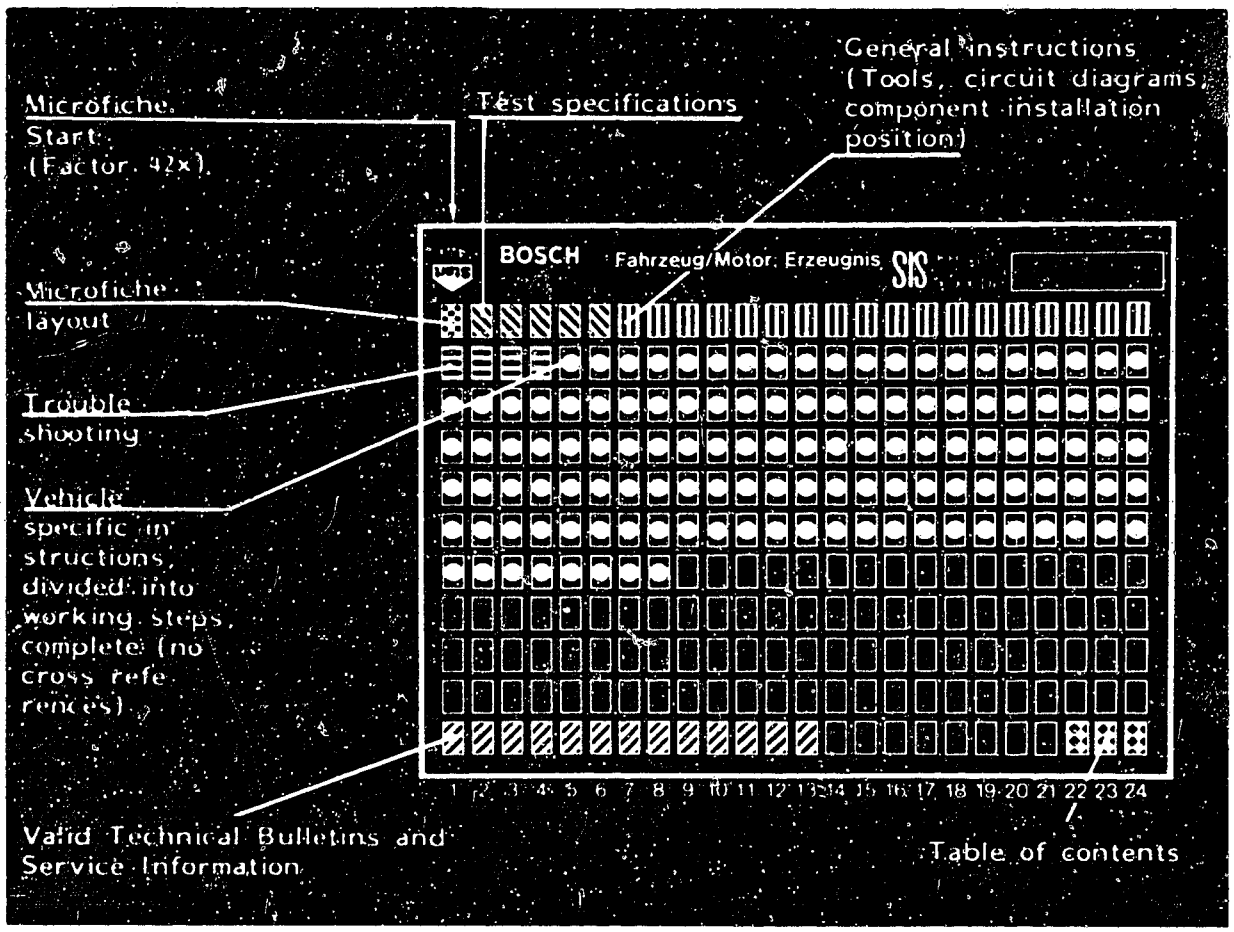
Microfiche layout



1. Read from left to right

2. Title of microfiche (appears on each coordinate)

E 16	Product/assembly/test step Vehicle/engine	

Coordinate

3. Limits of section

Beginning | Mid-section | End | One-page section

4. Purely vehicle-specific passages in the text are marked with a vertical bar. |

5. Reference to relevant working steps in the test specifications, e.g. coordinate C6.

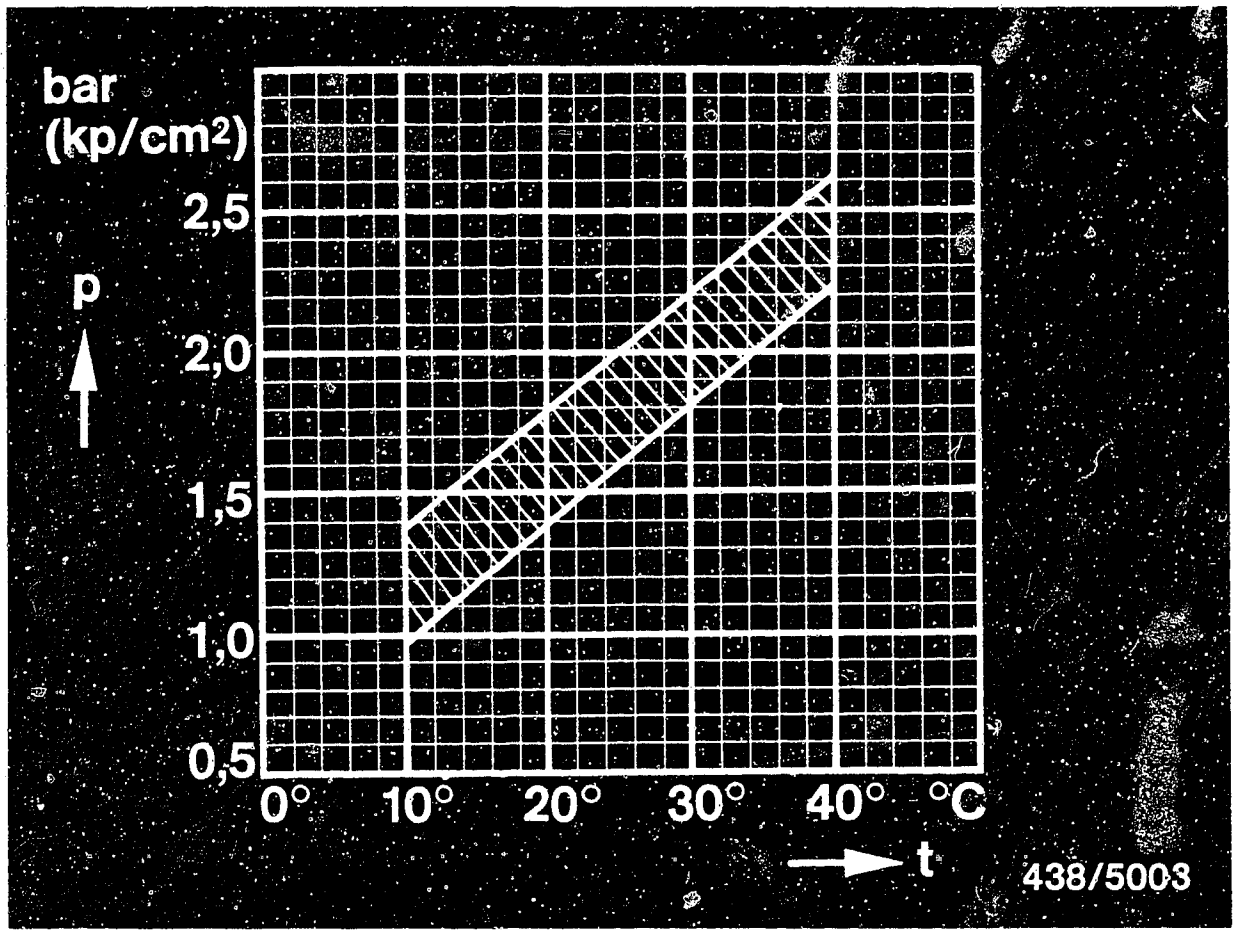
C 6

1. Test specifications

1.1 Electric fuel pump

C1

Test step	Test specifications
Fuel delivery	min. 750 cm^3/30 s



p = Control pressure (gauge pressure)
t = Ambient temperature

C19

1.2 Control pressure "cold"

Part No. of warm-up regulator: 0 438 140 004
.. 014

Test step	Test specifications
C22	
1.3 Control pressure "warm"	
Warm-up regulator 0 438 140 004 014	3.4...3.8 bar (3.5...3.9 kgf/cm²)
D1	
1.4 Primary pressure	
Fuel distributor 0 438 100 005	
Checking value	4.5...5.2 bar (4.6...5.3 kgf/cm²)
Setting value	4.7...4.9 bar (4.8...5.0 kgf/cm²)
D9	
1.5 Leak test	
Minimum pressure after 10 minutes: after 20 minutes:	 2.0 bar (2.1 kgf/cm²) 1.7 bar (1.8 kgf/cm²)
E1	
1.6 Injection valves	
0 437 502 007 Opening pressure:	 2.5...3.6 bar (2.6...3.7 kgf/cm²)

* Pressures in the test-specification table are given in bar (gauge pressure) and in kgf/cm² (gauge pressure)

1.7 Fuel distributor

E11

Delivered-quantity comparison.

Fuel distributor - Part No.:
0 438 100 005

	Setting point cm^3/min	Max. allowable delivery cm^3/min
Idle	6.0	6.8
Part load	40.0	44.0
Full load	160.0	175.0

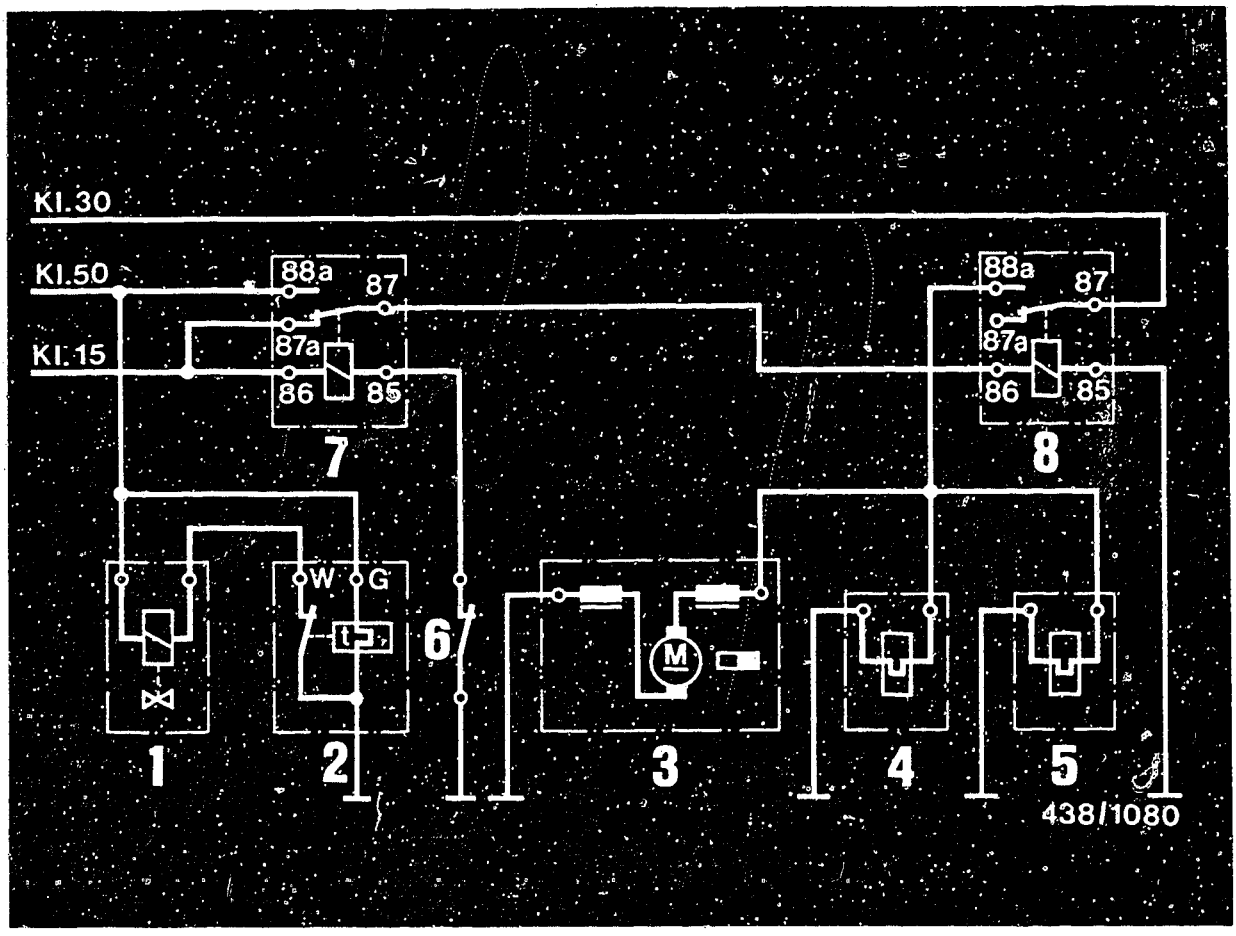
F1

1.8 Idle adjustment

Idle speed:	900 min^{-1}
CO concentration (% by vol.)*	
Checking value:	1.0...3.0 %
Setting value:	2.0 %

* Readjust the CO according to "setting value"

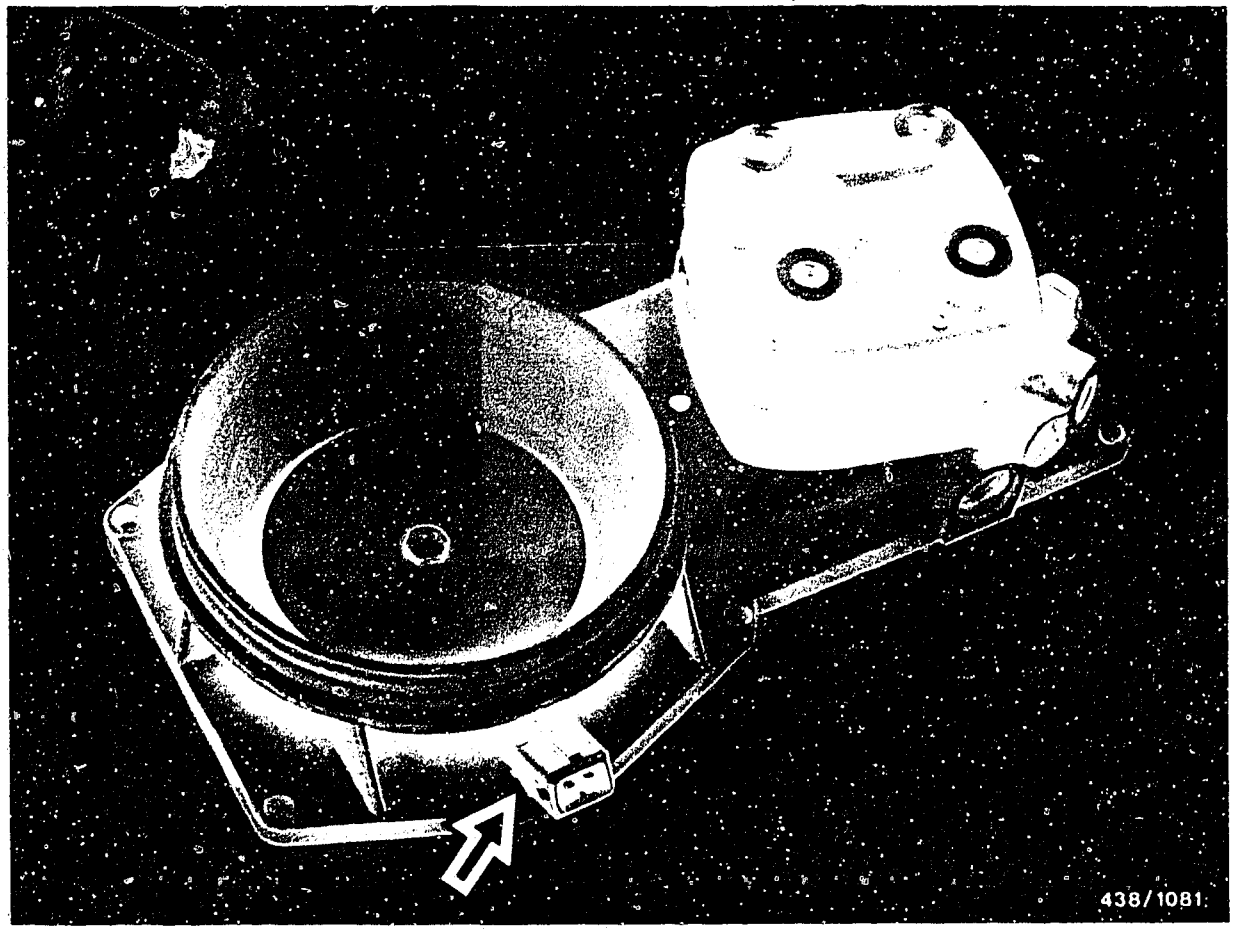
Engines whose CO concentration is within the checking tolerance need not be readjusted if otherwise running smoothly.



1 = Start valve
2 = Thermo-time switch
3 = Electric fuel pump
4 = Warm-up regulator
5 = Auxiliary-air device
6 = Air-flow sensor contact
7 = Relay 1
8 = Relay 2

2. Electrical circuit diagram (safety circuit)

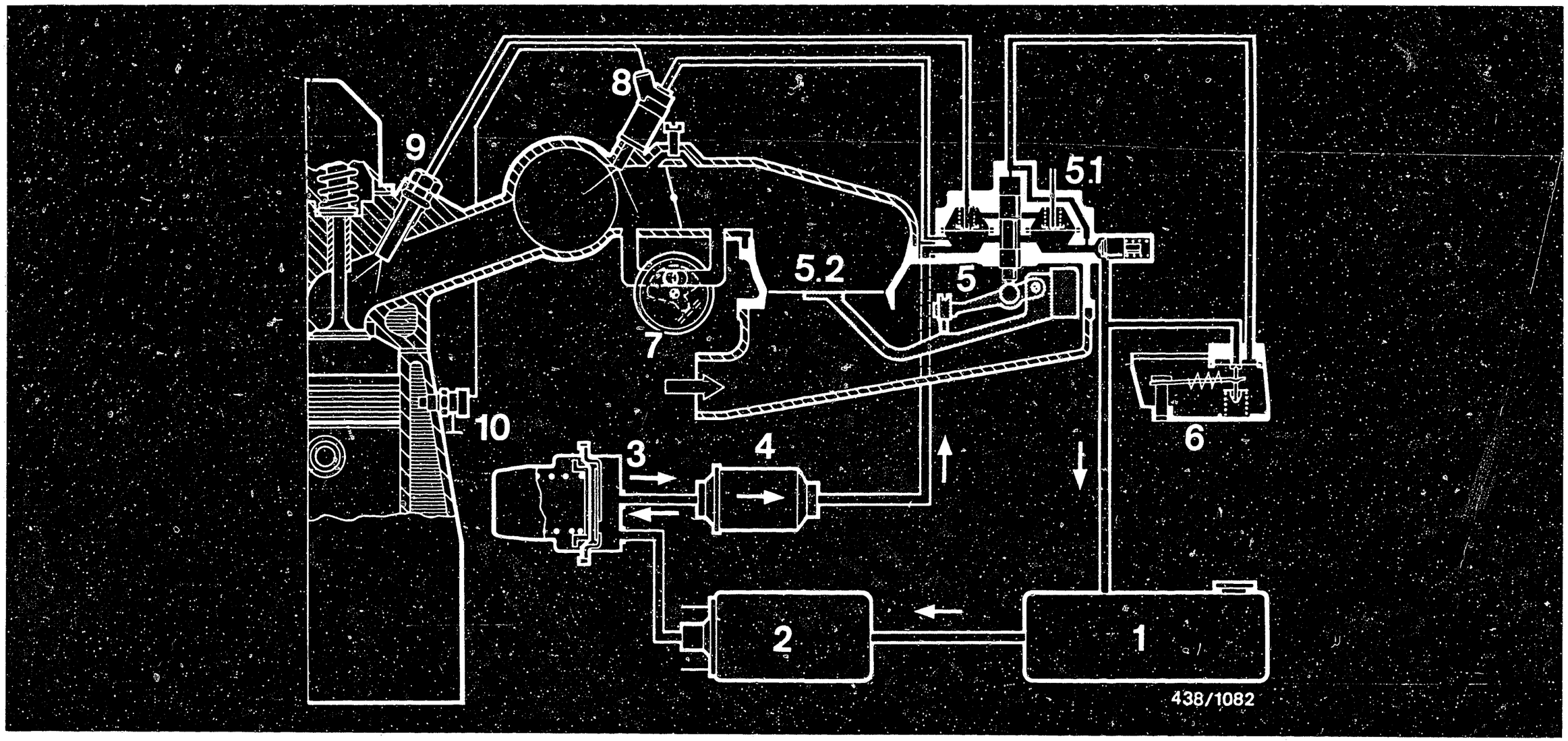
2.1 Circuit diagram



2.2 Bridging the safety circuit

In order to bridge the safety circuit it is sufficient to switch on the ignition and to remove the double connector from the socket on the air-flow sensor (arrow).

The components electric fuel pump, warm-up regulator and auxiliary-air device are triggered via relays I and II whereby the ignition must be on and the contact in the air-flow sensor open (air-flow sensor plate raised).



1 = Fuel tank
2 = Electric fuel pump
3 = Fuel accumulator
4 = Fuel filter
5 = Mixture-control unit
5.1 = Fuel distributor
5.2 = Air-flow sensor
6 = Warm-up regulator
7 = Auxiliary-air device
8 = Start valve
9 = Injection valve
10 = Thermo-time switch

3. Diagram of fuel lines

4. General information

4.1 Introduction

This repair instruction manual refers to the Volvo vehicle model 240 .. with engine versions

B 21 E (worldwide version), 1975-1955 model
B 21 F (USA version, without lambda closed-loop control) 1975/1976 model.

Both engine versions B 21 E, 1975-1977 model and B 21 F of the 1975/1976 model are identical as regards trouble-shooting and adjusting the K-Jetronic.
As of the 1977 model the USA engine B 21 F has lambda closed-loop control which is not dealt with in this repair instruction manual.

This repair instruction manual describes the testing and adjusting operations which are to be performed on the K-Jetronic on the vehicle.

All the system components are dealt with in separate working steps with the corresponding test specifications.

In addition to this repair manual the appropriate testing and repair manuals will, of course, be issued for every other vehicle type equipped with the K-Jetronic.

The K-Jetronic differs from other known fuel-injection systems in terms of both construction and operation. In order to be able to carry out the testing procedures described in this manual - and therefore to be able to assess the components - the K-Jetronic and its operation should be clearly understood. The essential points of the operation and construction of the K-Jetronic are described in Technical Instruction VDT-U 3/1 En.

When trouble-shooting the K-Jetronic, it is assumed that the ignition is in order and that the engine is in proper mechanical condition.

The individual test steps of this repair manual are detailed and self-contained. This permits direct trouble-shooting without having to go through the entire test program for each fault.

The trouble-shooting chart on Coordinates B 1 - B 4 is intended to make it easier to decide which test steps have to be carried out for certain faults.

According to the symptom stated by the customer or which you yourself have determined, select the possible cause in the trouble-shooting chart. The coordinate at the end of the cause column refers to the appropriate test step with the associated test specification.

Important note:

If any fuel connections are loosened, parts removed, also on the vacuum system, always use new seals when re-connecting or re-installing.

Ensure utmost cleanliness when working on the K-Jetronic. Fuel connections must be cleaned thoroughly on the outside before opening.

C A U T I O N !

When testing with the electric fuel pump operating, never deflect (raise) the air-flow sensor plate since fuel will be injected through the injection valves. When the engine is subsequently started this may lead to serious engine damage.

4.2 Design of K-Jetronic

The entire system of the K-Jetronic in the Volvo 240 .. corresponds to the basic design as described in Technical Instruction VDT-U 3/1.

4.3 Electrical safety circuit:

The electric fuel pump, warm-up regulator and auxiliary-air device are controlled by 2 relays whereby the control relay switches as a function of the safety contact in the air-flow sensor (air-flow sensor plate stop).

As usual, the start valve is triggered by the thermo-time switch during cold starting in accordance with the engine temperature.

4.4 Hot-starting device:

In order to improve the hot-starting performance, the Ford 2.8 i engines are equipped as standard as of the 1980 model with a pulse relay for the intermittent triggering of the start valve.

5. Test equipment and tools

- Pressure tester KDJE-P 100 (previously KDEP 1034)

For testing all fuel pressures and testing for leaks.

- Connecting-parts set KDJE-P 100/10 (previously KDEP 1034/10)

For connecting pressure tester KDJE-P 100 (previously 1034/10) to the control-pressure port of the fuel distributor.

- Adjusting wrench KDEP 1035

For adjusting the idle-mixture-adjusting screw in the mixture-control unit (CO-adjustment).

- Guide ring KDEP 1040/10 (dia. 80 mm)

For centering the air-flow sensor plate in the air-flow sensor.

- Tester for delivered quantity comparison KDJE-P 200 (previously KDJE 7451)

For comparing the fuel delivered from the individual fuel-distributor outlets.

- Electric connecting cable (test lead)

KDJE 7450/70 for the direct connection of components to be tested, e.g. cold-start valve.

- Graduate (commercially available, capacity approx. 1.5 l)

For measuring the delivery of the electric fuel pump.

- Valve tester KDJE-P 400 (previously KDJE 7452).

For testing the injection valves.

Test media: Calibrating fluid (Shell K 30, Esso-Varsol, Shell Mineral Spirits 135)
or
Bosch, Part Designation 14 942-CH
Previously, Part No. 5 973 340 650
The Bosch calibrating fluid can be obtained in 5 l metal cans from the following supplier:

Firma
Oskar Gnamm GmbH & Co.
D-7531 Kämpfelbach-Bilfingen

Caution:
For safety reasons, never use normal gasoline or similar easily inflammable and combustible liquids.
Even with calibrating fluid, be sure to observe the local official regulations.

- Tachometer (commercially available)

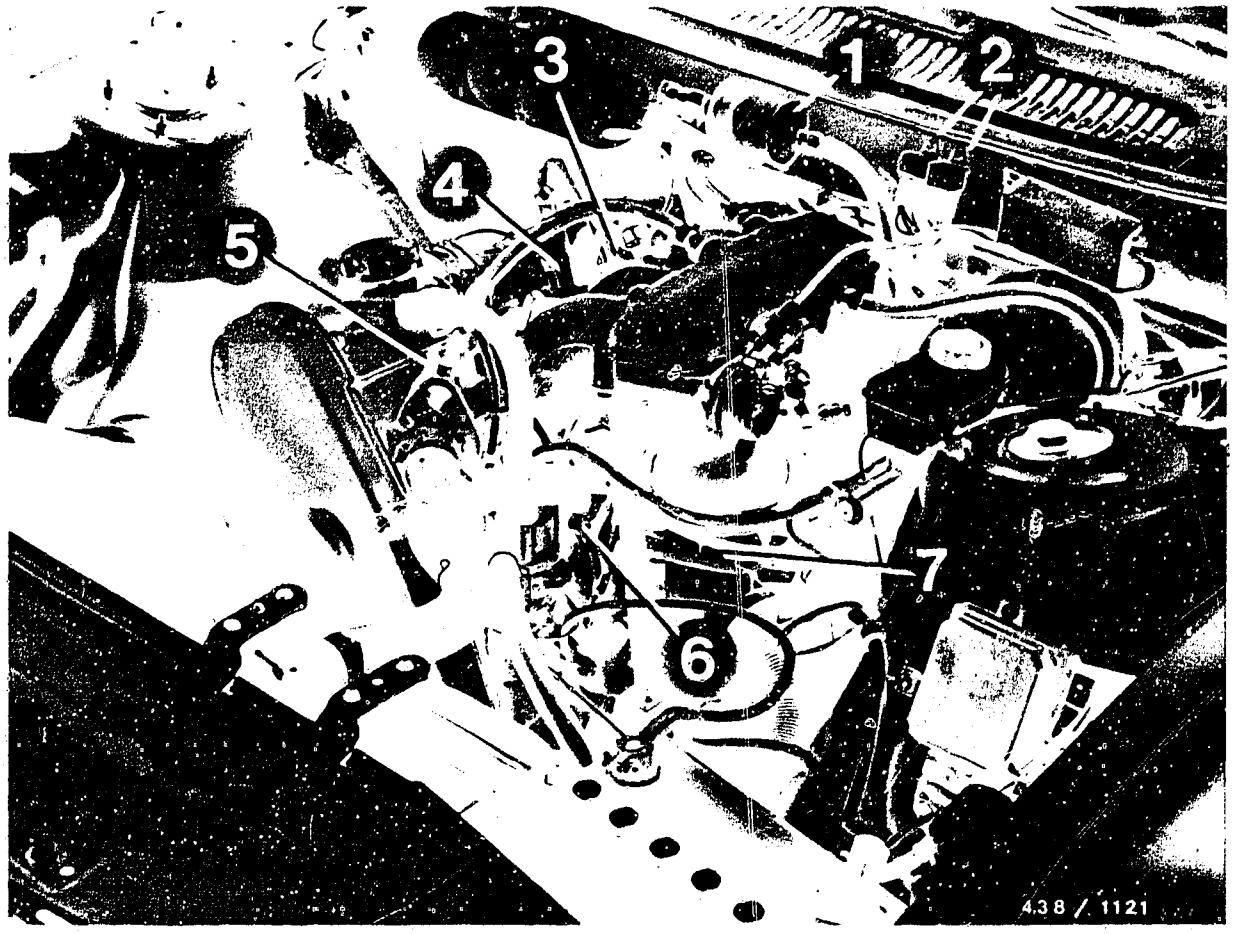
 For adjusting the idle speed

- CO analyzer (commercially available)

 For adjusting the idle CO.

- Assembly tool KDEP 1039

 For mounting the polyamide hose line on the delivery fitting of the electric fuel pump.

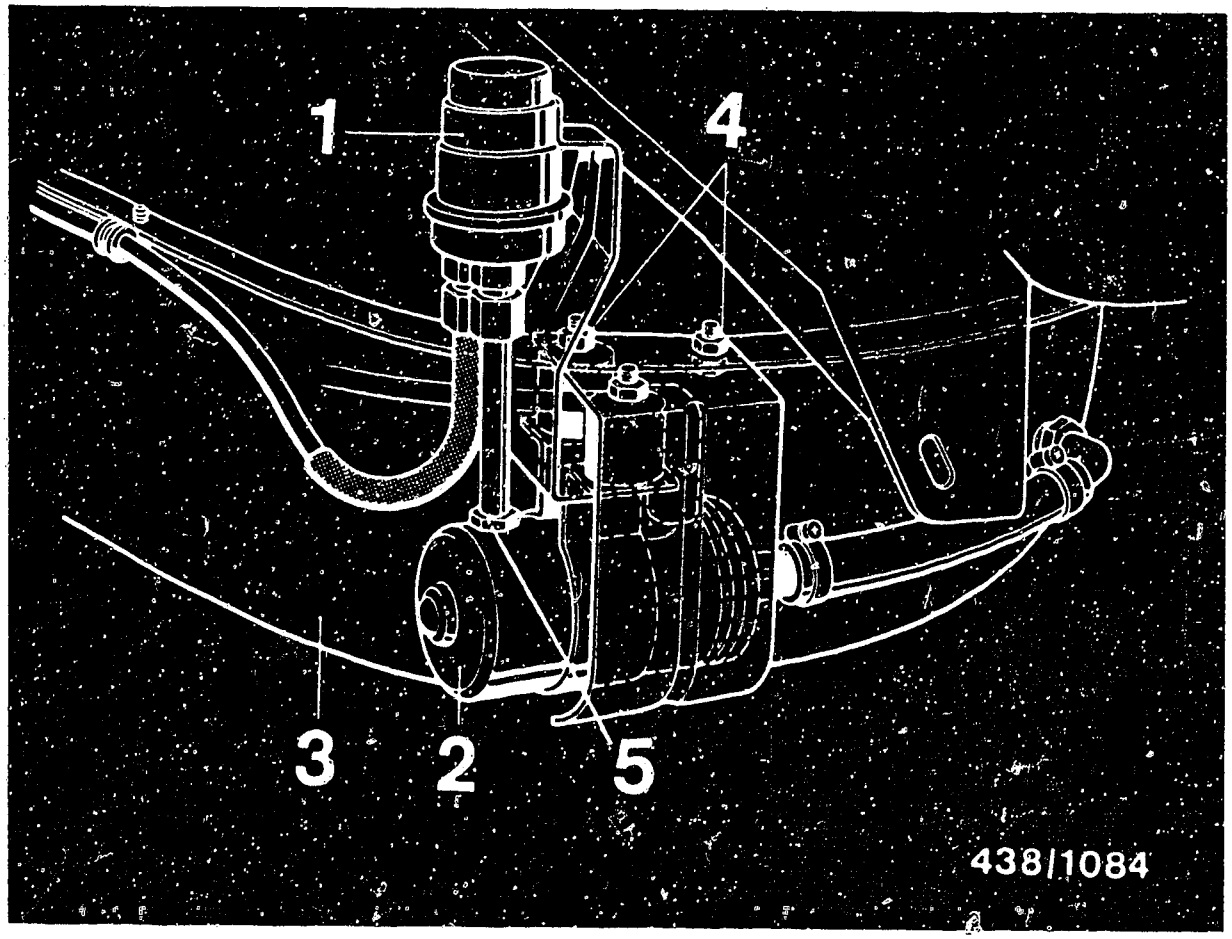


1 = Fuel filter
2 = Safety circuit relay
3 = Start valve
4 = Auxiliary-air device
5 = Injection valves
6 = Warm-up regulator
7 = Mixture-control unit

6. Installation position of individual components

6.1 Arrangement of components on engine

The thermo-time switch (not visible in picture) is in the engine block under the intake port flange of cylinder 4.



1 = Fuel accumulator
2 = Electric fuel pump
3 = Fuel tank
4 = Fastening nuts of bracket
5 = Delivery fitting

6.2 Fuel-supply components

The electric fuel pump and fuel accumulator are on a common bracket which is mounted under the luggage compartment floor, on the left-hand side as viewed in the forward direction of travel, next to the fuel tank.

7. Trouble-shooting chart

When trouble-shooting the K-Jetronic, it is assumed that the ignition is in order and that the engine is in proper mechanical condition.

The individual test steps of this repair manual are detailed and self-contained. This permits pin-pointed trouble-shooting without having to go through the entire test program for each fault.

The trouble-shooting chart on Coordinates B 2 - B 5 is intended to make it easier to decide which test steps have to be performed for which faults.

Select the possible cause in the trouble-shooting chart in accordance with the complaint stated by the customer or which you yourself have determined. The Coordinate at the end of the cause column refers to the appropriate test step with the corresponding test specification.

7. Trouble-shooting chart (see also Coordinates (B 4/B 5)

Customer complaint (fault symptom)

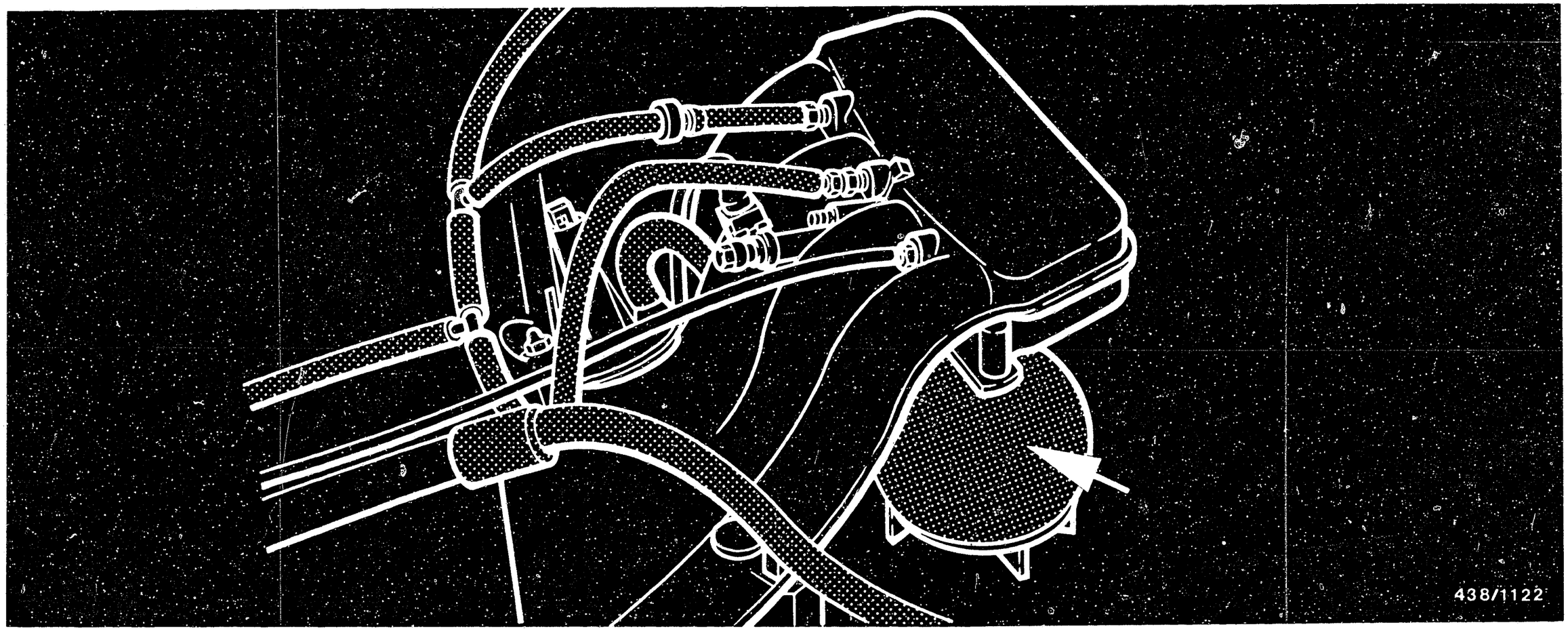
1. Engine does not start, or starts poorly, in cold condition
2. Engine does not start, or starts poorly, in warm condition*
3. Irregular idling during the warm-up phase (shakes)
4. Irregular idling with warm engine (shakes)
5. Engine does not draw gas, burbles
6. Engine misfires when operating on the road, high load
7. Insufficient power

1	2	3	4	5	6	7	Cause	Coordinates
	●	●	●	●		●	Vacuum system leaking	B 6
●	●		●	●	●	●	Air-flow sensor lever and/or control plunger not moving smoothly	B 8
	●						Position of the air-flow sensor plate incorrect	B19
●		●					Auxiliary-air device does not open	B23
●	●				●		Electric fuel pump not operating	C 1
●							Cold-start system defective	C 7
		●	●				Cold-start valve leaking	C10
				●			Excessive fuel delivery for control-pressure circuit	C12
●		●					"Cold" control pressure outside tolerance	C19
	●		●	●	●	●	"Warm" control pressure too high (after warm-up)	C22
			●	●		●	"Warm" control pressure too low (after warm-up)	C22
					●	●	Primary (system) pressure outside tolerance	D 1
	●						Overall fuel system leaking	D 9
●	●	●	●		●		Injection valves leaking, opening pressure too low	E 1
●	●	●	●			●	Unequal fuel delivery (imbalance of fuel delivery)	E11
●	●	●	●	●			Basic idle adjustment incorrect	F 1
						●	Throttle plate does not open completely	---

*Note:
If, in the case of Symptom 2, after checking and repairing all the fault causes listed below, the hot-start characteristic is still unsatisfactory this can be improved by fitting an impulse relay.
The fitting of this relay is described in Coordinates L 4.

Customer complaint (fault symptom) (continued)

8. Engine runs on after being switched off ("diesels")	9. Fuel consumption too high	10. Flat spot during acceleration	11. CO concentration during idling too high	12. CO concentration during idling too low	13. Idle-speed cannot be adjusted (too high)	14. Engine starts but then immediately stops	Cause	Coordinates
		●		●			Vacuum system leaking	B 6
●		●	●	●			Air-flow sensor and/or control plunger not moving smoothly	B 8
●							Position of the air-flow sensor plate incorrect	B19
					●		Auxiliary-air device does not close	B23
						●	Electric fuel pump not operating	C 1
●	●		●				Cold-start valve leaking	C10
		●				●	Excessive fuel delivery for control-pressure circuit	C12
		●				●	"Warm" control pressure too high (after warm-up)	C22
	●	●	●			●	"Warm" control pressure too low (after warm-up)	C22
		●				●	Primary (system) pressure outside tolerance	D 1
●							Injection valves leaking, opening pressure too low	E 1
		●					Unequal fuel delivery (imbalance of fuel delivery)	E11
●	●	●	●	●			Basic idle adjustment incorrect	F 1



Test steps

8. Checking the air-intake system (vacuum system) of the engine for leaks

First of all, visually examine the condition of all connectors and connections on the intake system. Pay particular attention to the air-intake dome between air-flow sensor and throttle-valve assembly (arrow) and to all hose lines connected to the intake manifold.

If visual examination is not clear, proceed as follows:
Remove hose from outlet of auxiliary-air device and, using compressed-air gun, blow air through this hose into the air-intake system. Open the throttle valve fully while doing this. Brush joints with soapy water or spray with leak detector (e.g. Güpoflex).
Under no circumstances use combustible liquids when testing for leaks.
Bubbling or foaming indicates a leak.

When a leak has been remedied, then perform the idle adjustment with the engine at normal operating temperature. Idle adjustment is described as of Coordinate F 1.

9. Check the control lever in the air-flow sensor and the control plunger in the fuel distributor for ease of movement.

9.1 Preparations

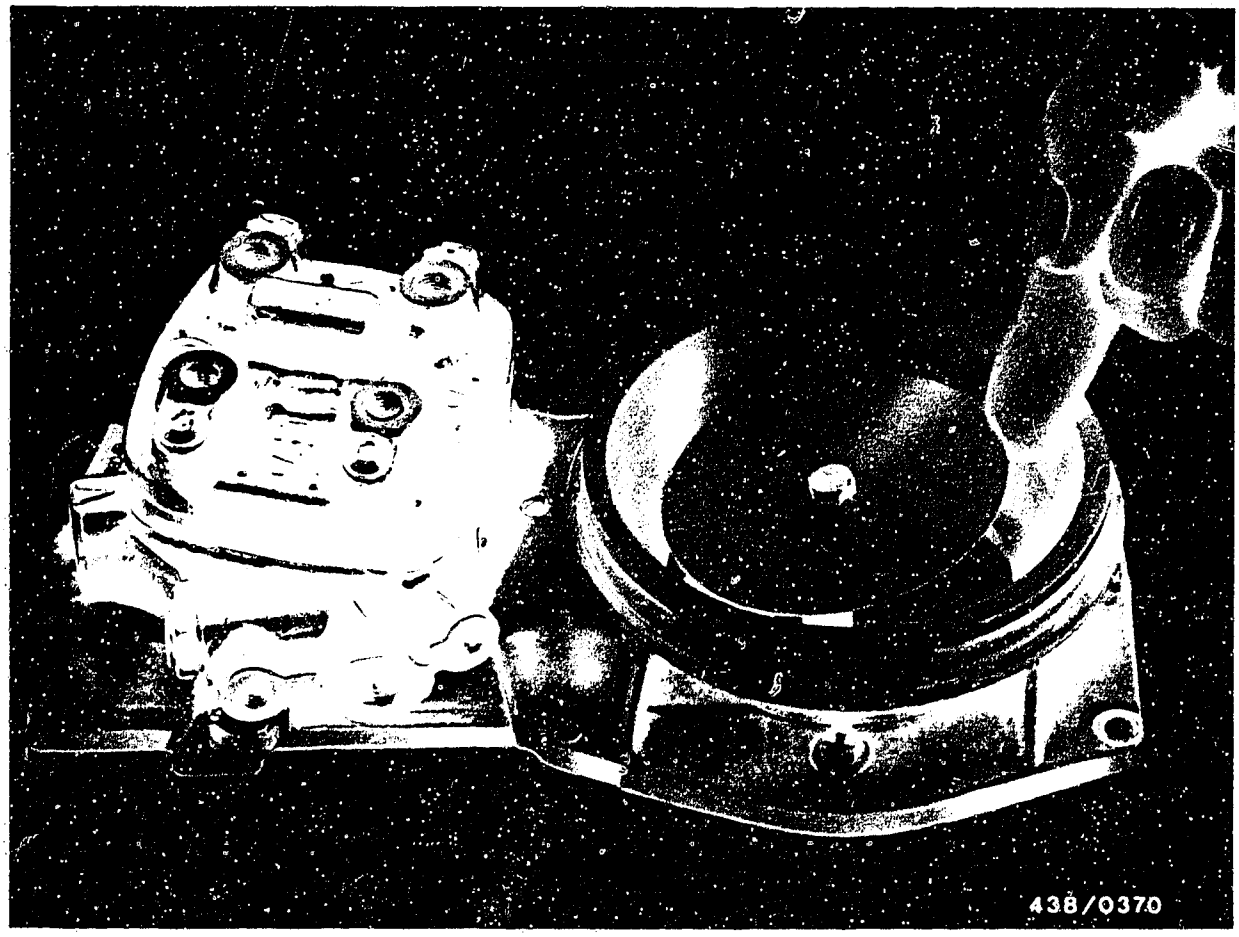
Engine temperature not below +20°C

Remove the rubber dome from the air-flow sensor so that the air-flow sensor plate becomes accessible.

Switch on the electric fuel pump for approx. 10 seconds by bridging the safety circuit.
This results in application of the control pressure to the control plunger in the fuel distributor.

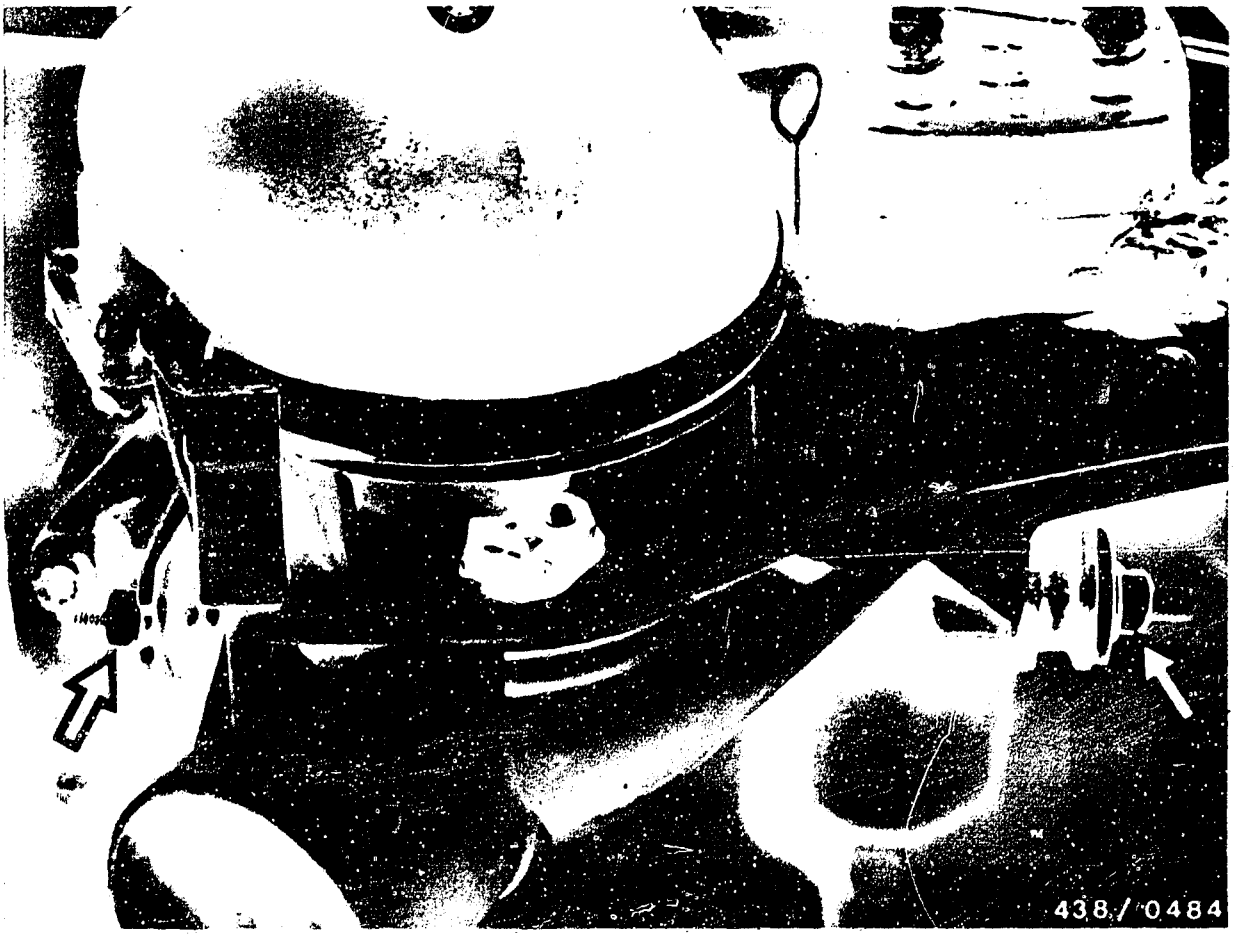
C A U T I O N !

When testing with the electric fuel pump operating, never deflect (raise) the air-flow sensor plate since fuel will be injected through the injection valves. When the engine is subsequently started this may lead to serious engine damage.



9.2 Check that the control lever moves freely

Raise the air-flow sensor plate by hand (updraft) and release again. The sensor plate snaps back into the zero position and bounces up about twice from the spring-loaded stop. If the control lever does not move freely, first release all fastening screws holding the air-flow sensor to determine whether housing deformation is the cause of the problem.
If the problem is solved by loosening the fastening screws, the seal between the air-supply housing and air-flow sensor should be changed (Volvo parts).
Tighten the screws uniformly cross-wise to a torque of 9...10 Nm (0.9...1.0 kgfm).
If the housing is not deformed, then the air-flow sensor must be repaired or replaced.



9.3 Removing and installing the air-flow sensor and the complete mixture-control unit:

Since the rear fastening screws of the mixture-control unit are not readily accessible, it is a good idea to remove the mixture-control unit together with the bracket.

Sequence of operations:
Remove the air-guide hose between air filter and bracket.
Remove the connection dome between air-flow sensor and throttle-valve assembly.
Remove the plug from the air-flow sensor and unscrew all fuel lines from the fuel distributor.
Unscrew the fastening nuts on the rubber-bonded metal buffers (arrows) of the bracket and remove the bracket together with the mixture-control unit.

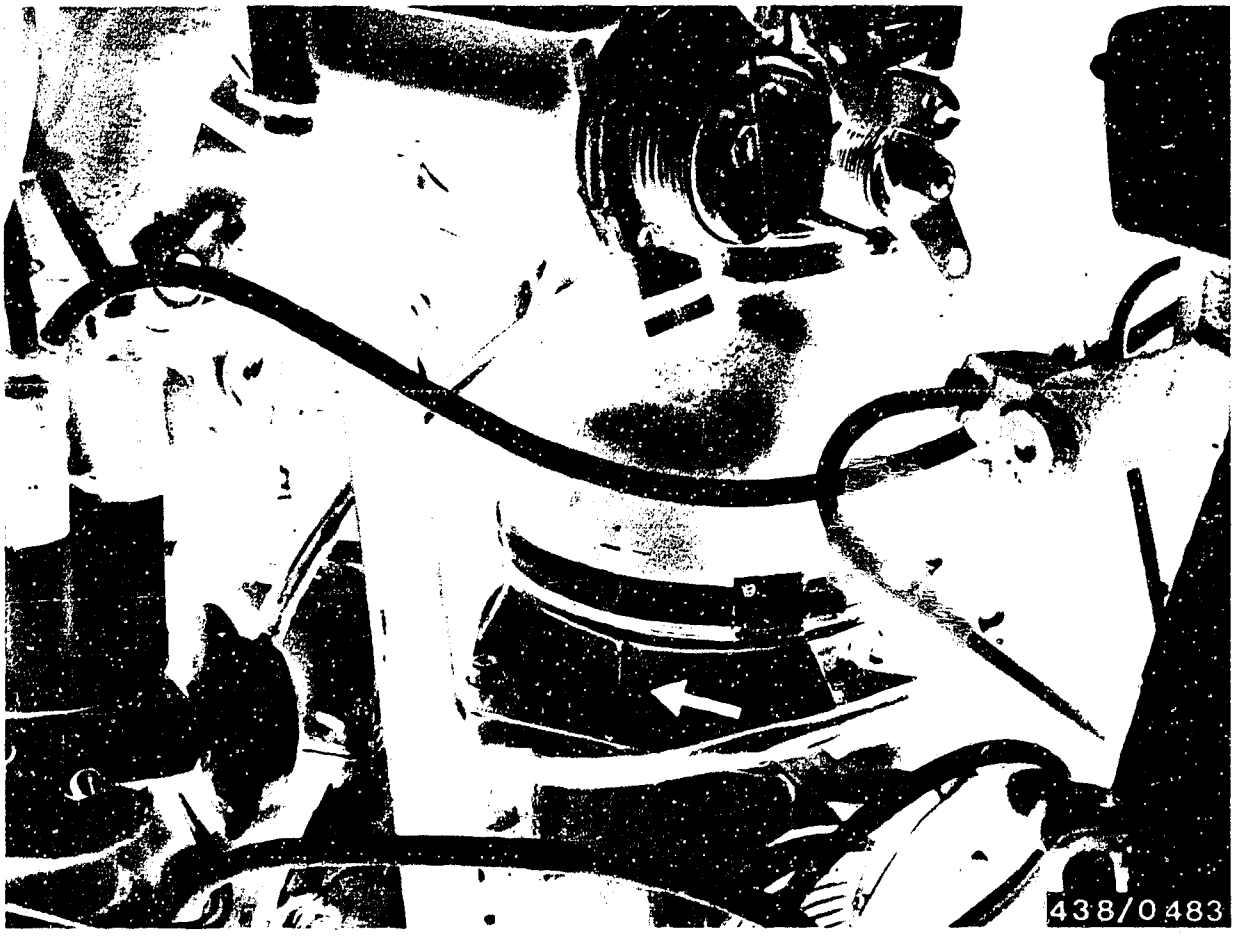
Important!

Note the following when installing fuel components and fuel lines:

Always ensure utmost cleanliness when loosening or tightening the fuel connections. No dirt must enter the fuel system.

When loosening or tightening the fuel connections, apply counter-force at the fixed hexagon of the component.

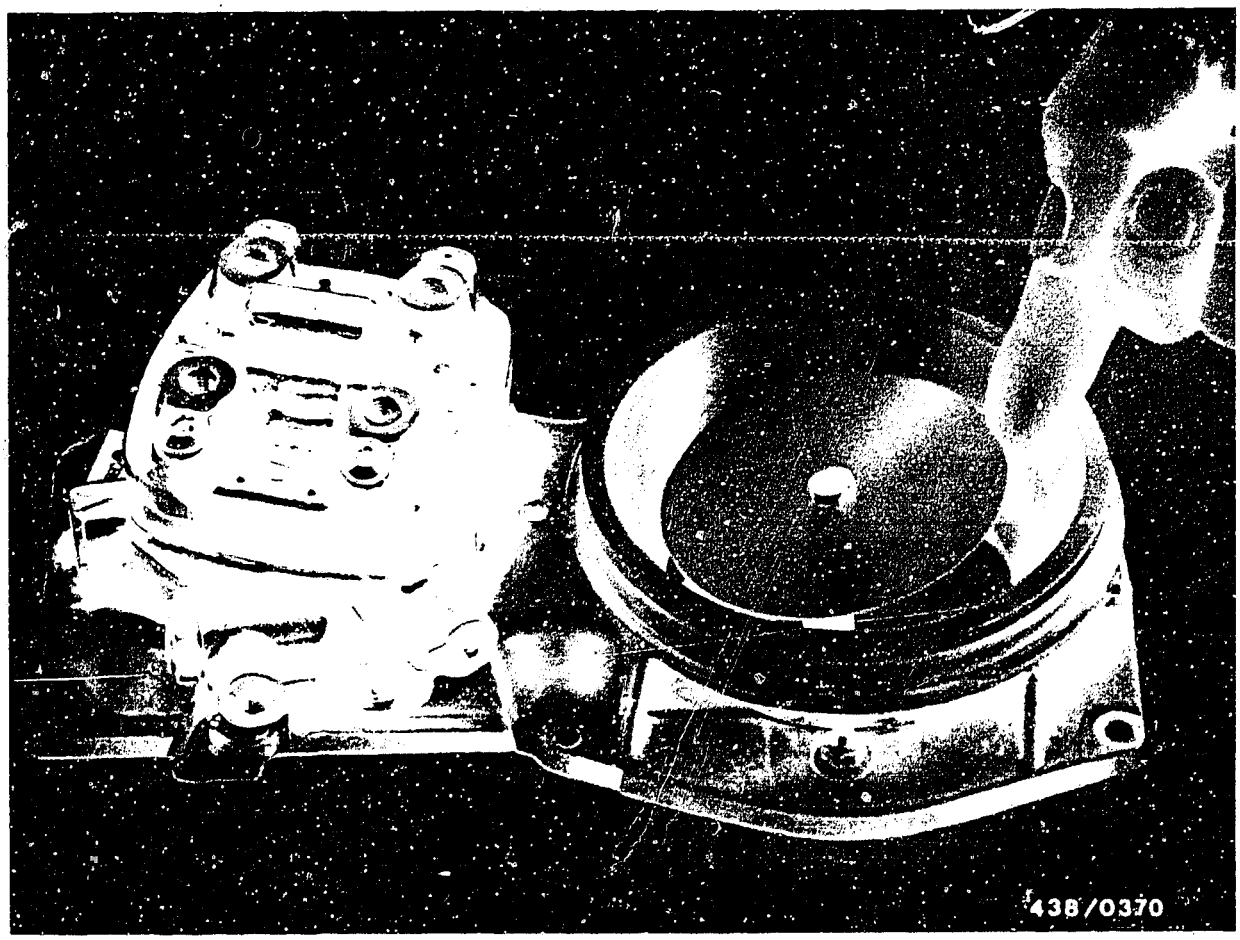
Clean the fuel distributor thoroughly in the region of the fuel connections.



If the mixture-control unit has been removed from the bracket, then use a new seal when installing.
Tighten the fastening screws of the mixture-control unit uniformly.

Install in the reverse order. Always install the fuel lines with new seal rings.

Install the connection dome between air-flow sensor and throttle-valve assembly so that the arrow points to the reinforcing rib in the air-flow sensor housing (arrow).



9.4 Check that the control plunger moves freely

Raise the air-flow sensor plate by hand (updraft). The same resistance must be felt over the entire movement.

Move the sensor plate rapidly back to a position just in front of the zero stop. The control plunger follows only sluggishly, but must make noticeable contact with the sensor plate lever. If this condition is fulfilled, the control plunger can be considered to move freely.

If the control plunger does not move freely, remove the fuel distributor from the air-flow sensor.

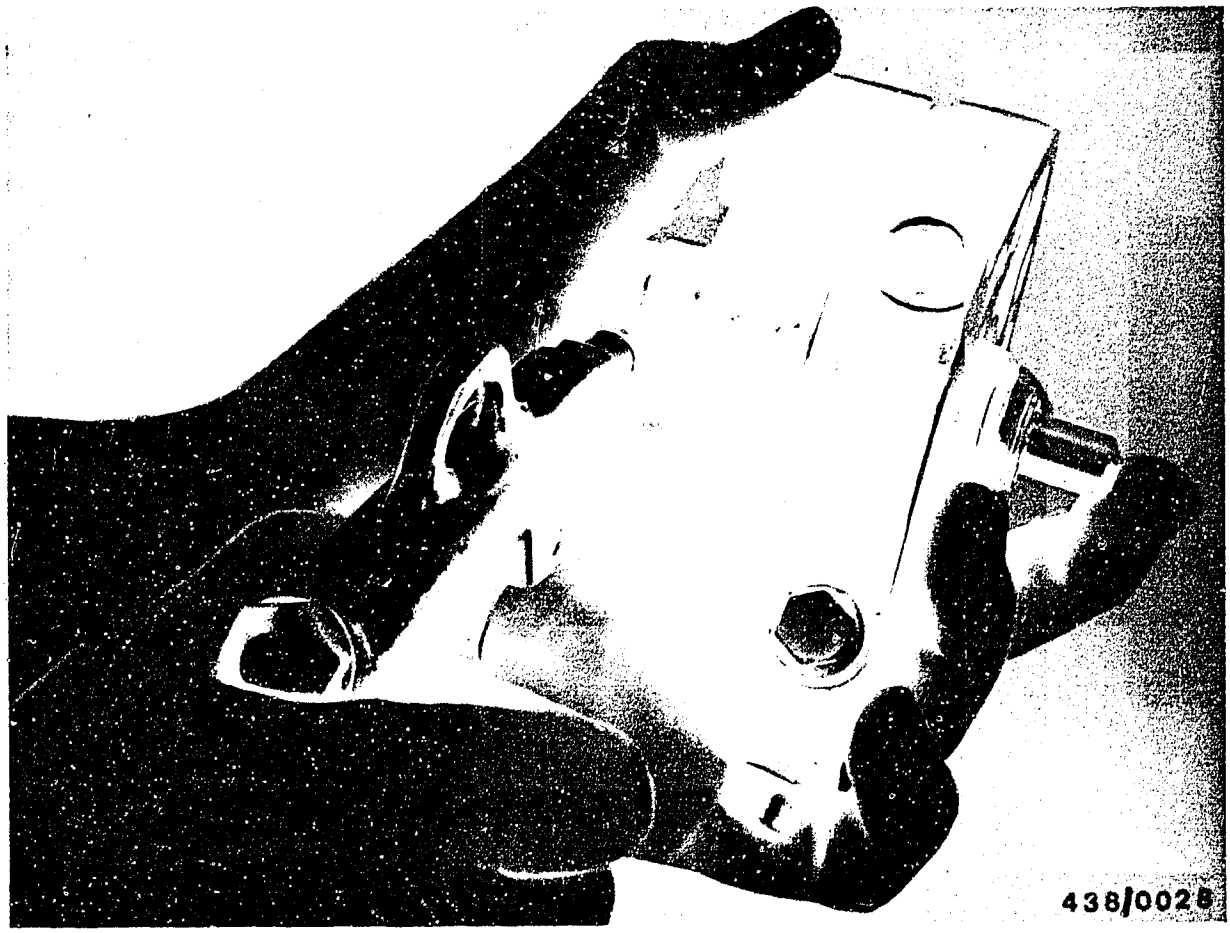
Important!

Note the following when installing fuel components and fuel lines:

Always ensure utmost cleanliness when loosening or tightening the fuel connections. No dirt must enter the fuel system.

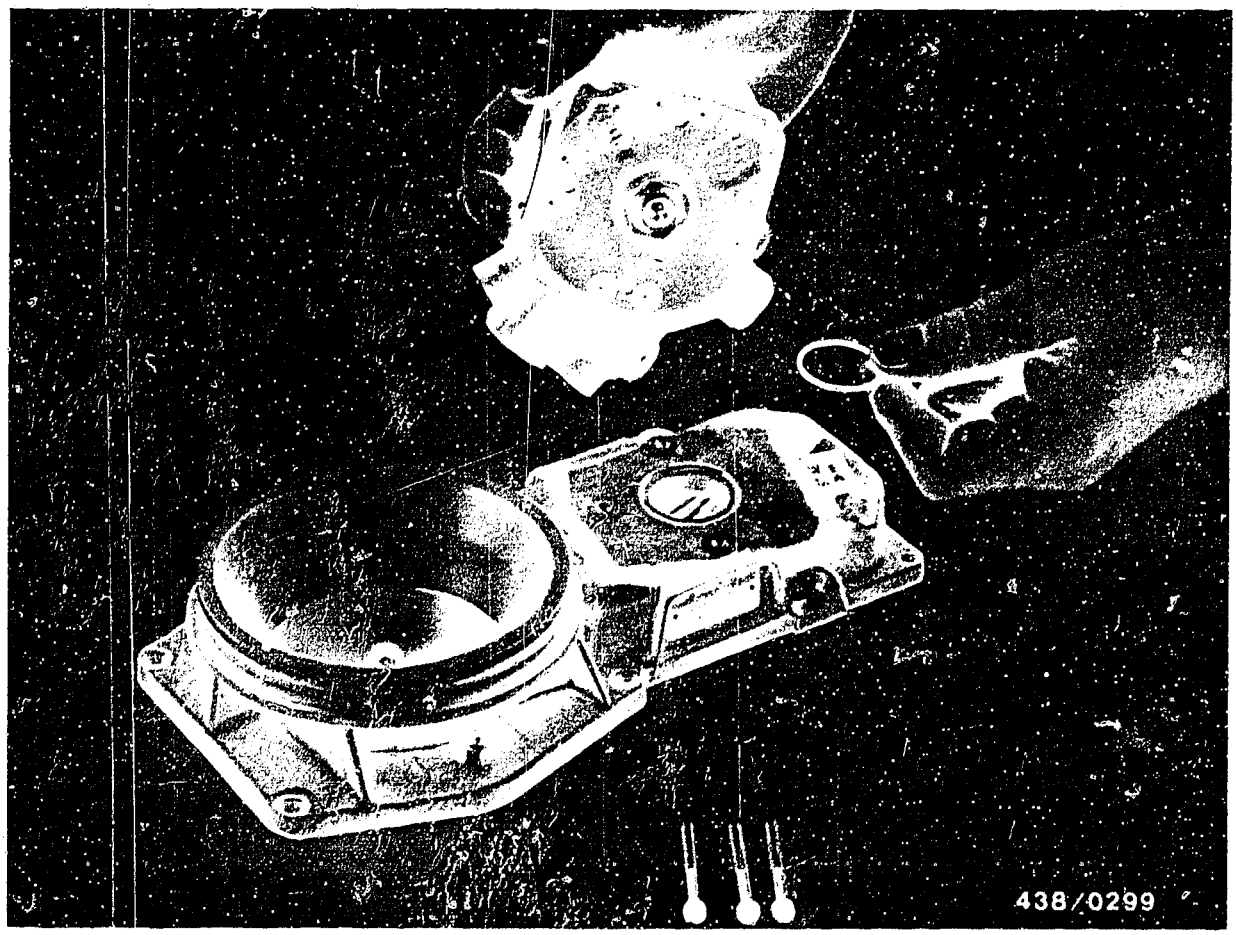
When loosening or tightening the fuel connections, apply counter-force at the fixed hexagon of the component.

Clean the fuel distributor thoroughly in the region of the fuel connections. Screw off all connections.



Screw out three fastening screws and remove the fuel distributor from the air-flow sensor.

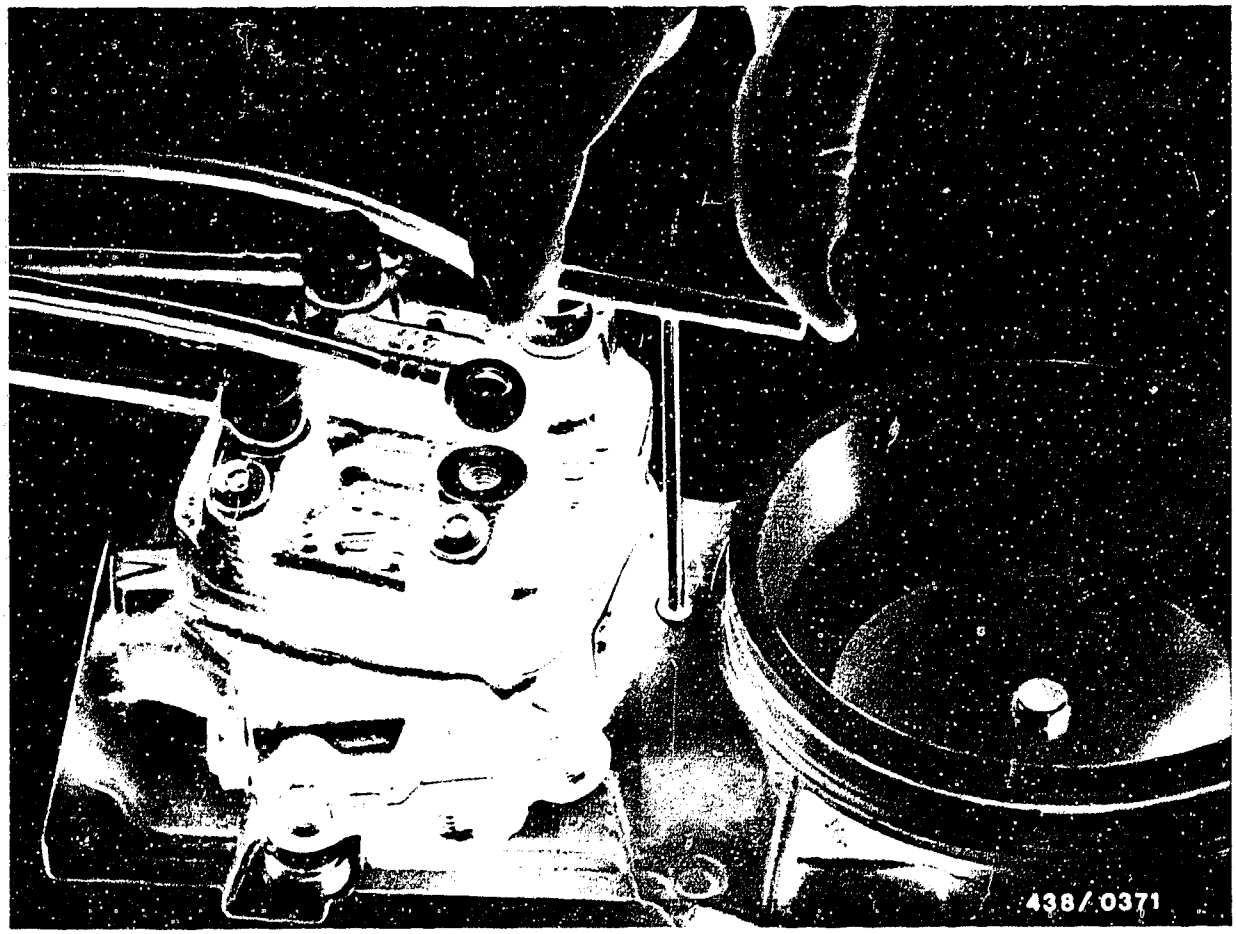
Remove the plunger. Under certain conditions, in order to do this it may be necessary to blow compressed air briefly against the plunger through the control-pressure connection hole. Hold the plunger with your hand while doing this. Clean the plunger thoroughly with benzine. If the plunger still does not move freely, replace the fuel distributor



9.5 Fitting the fuel distributor

When fitting the fuel distributor, use a new seal ring between fuel distributor and air-flow sensor. Observe the tightening torque 3.2...3.8 Nm (0.32... 0.38 kgfm) for the fastening screws precisely.

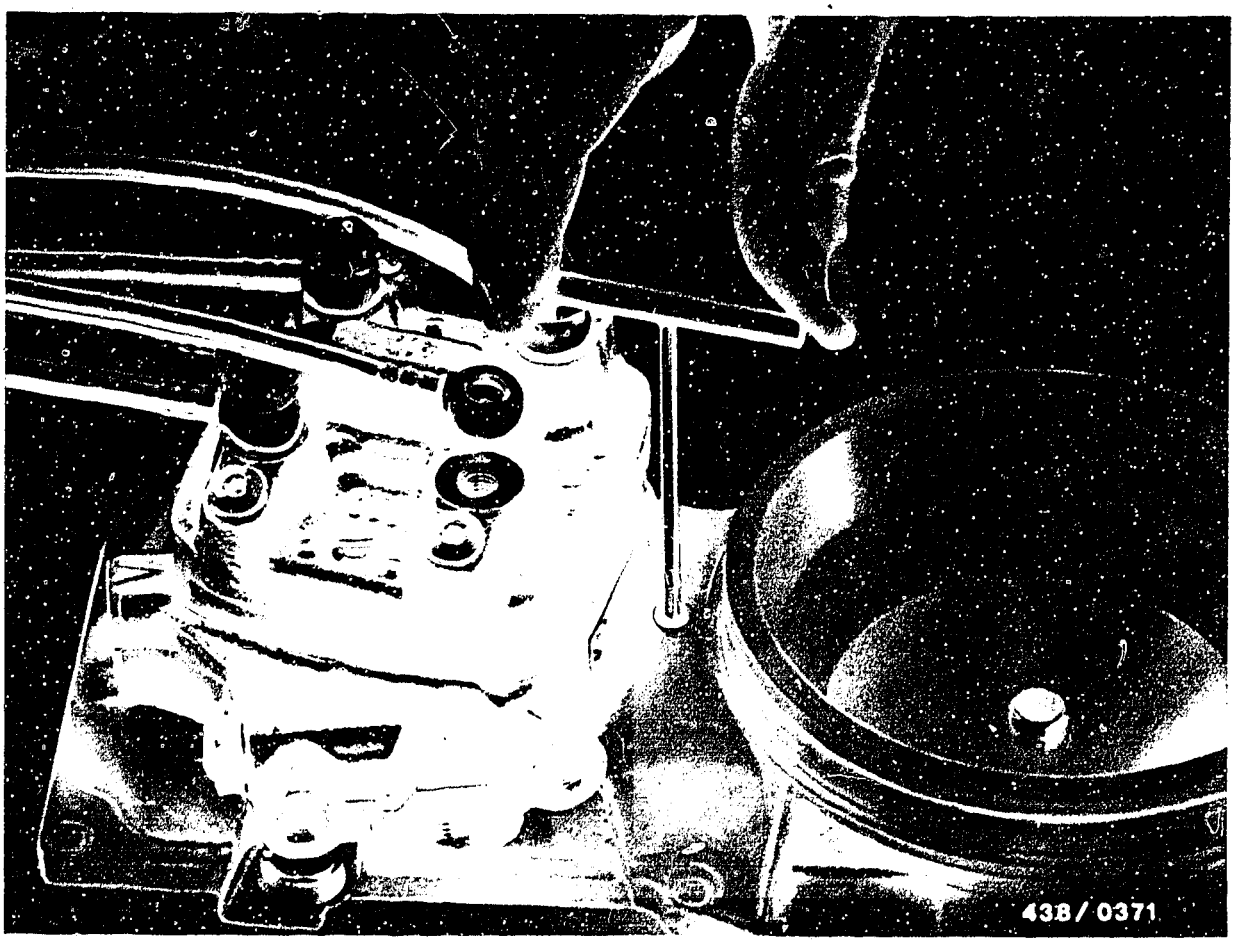
When connecting the fuel-injection tubing, use new seal rings.



9.6 Matching the fuel distributor to the air-flow sensor for initial start

Unscrew one injection line from the fuel distributor.
Bridge the electrical safety circuit so that the electric fuel pump operates.

Remove the rubber plug from the access bore to the idle-mixture-adjusting screw in the air-flow sensor.
Insert adjusting wrench KDEP 1035 through the bore into the idle-mixture-adjusting screw.



Screw in the idle-mixture-adjusting screw slowly and without exerting any great pressure on the adjusting wrench until fuel is just delivered from the open outlet (arrow) of the fuel distributor. Then turn back the idle-mixture screw by 1/2 turn.

Re-connect the fuel-injection line to the fuel distributor, start the engine and warm up.

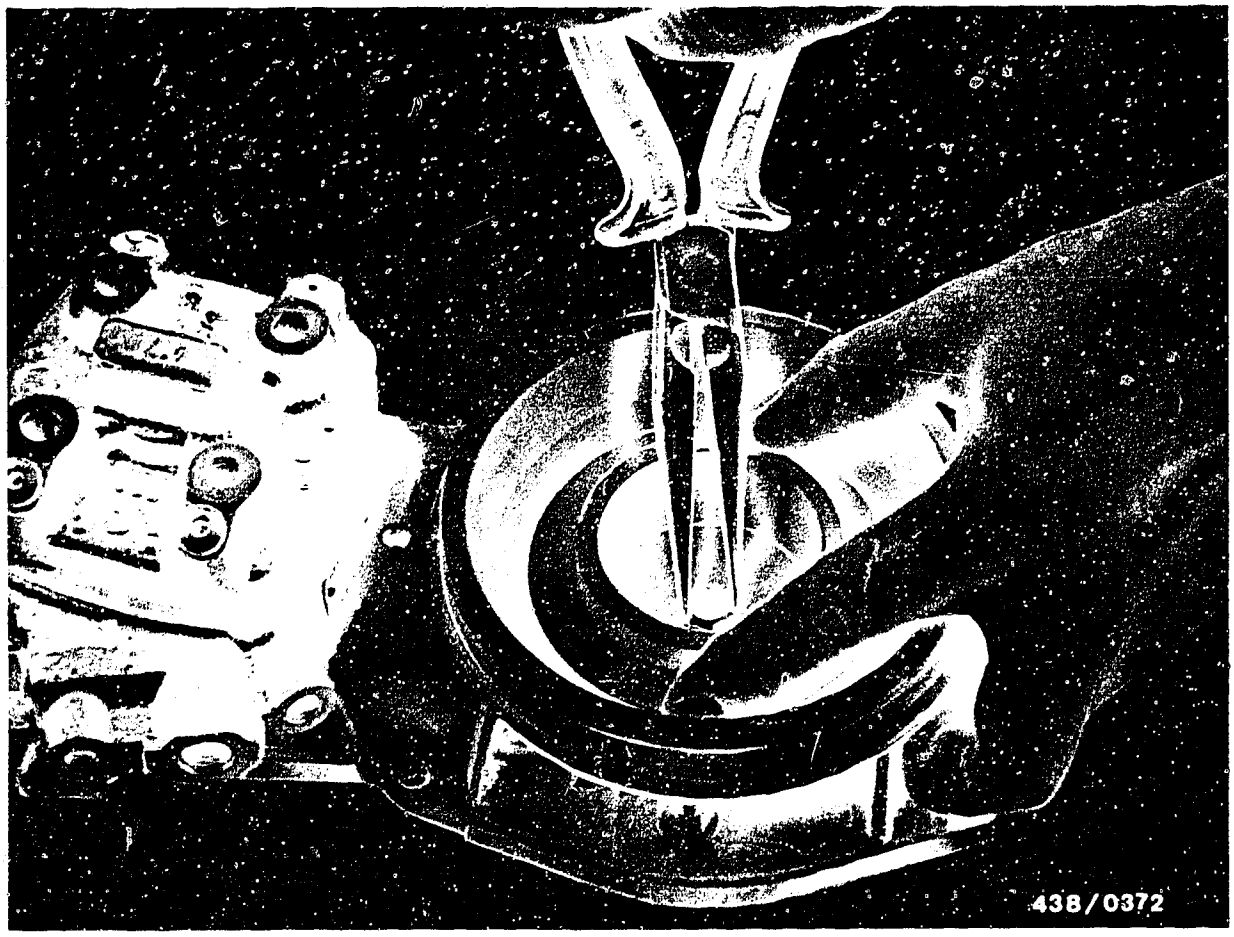
The final matching of air-flow sensor and fuel distributor is carried out by adjusting the idle speed with the engine at normal operating temperature.

Idle-speed adjustment is described on Coordinates F 1,

10. Checking and adjusting the position of the air-flow sensor plate

10.1 Preparations

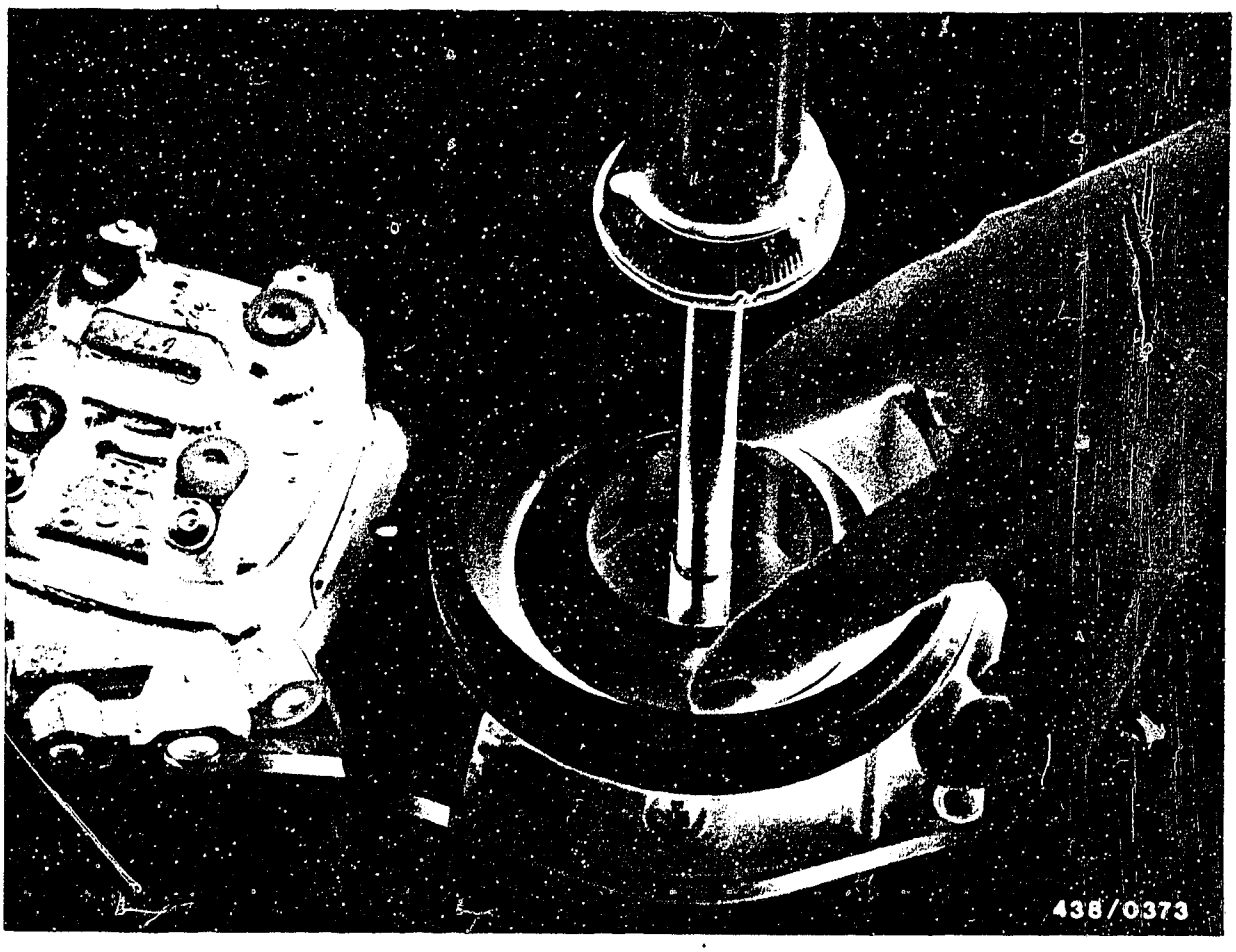
- Engine temperature is not important.
- Remove the rubber hood fitted between the air-flow sensor and the throttle-valve assembly (release 2 clamping bands), so that the air-flow sensor plate becomes accessible.



10.2 Centering the air-flow sensor plate

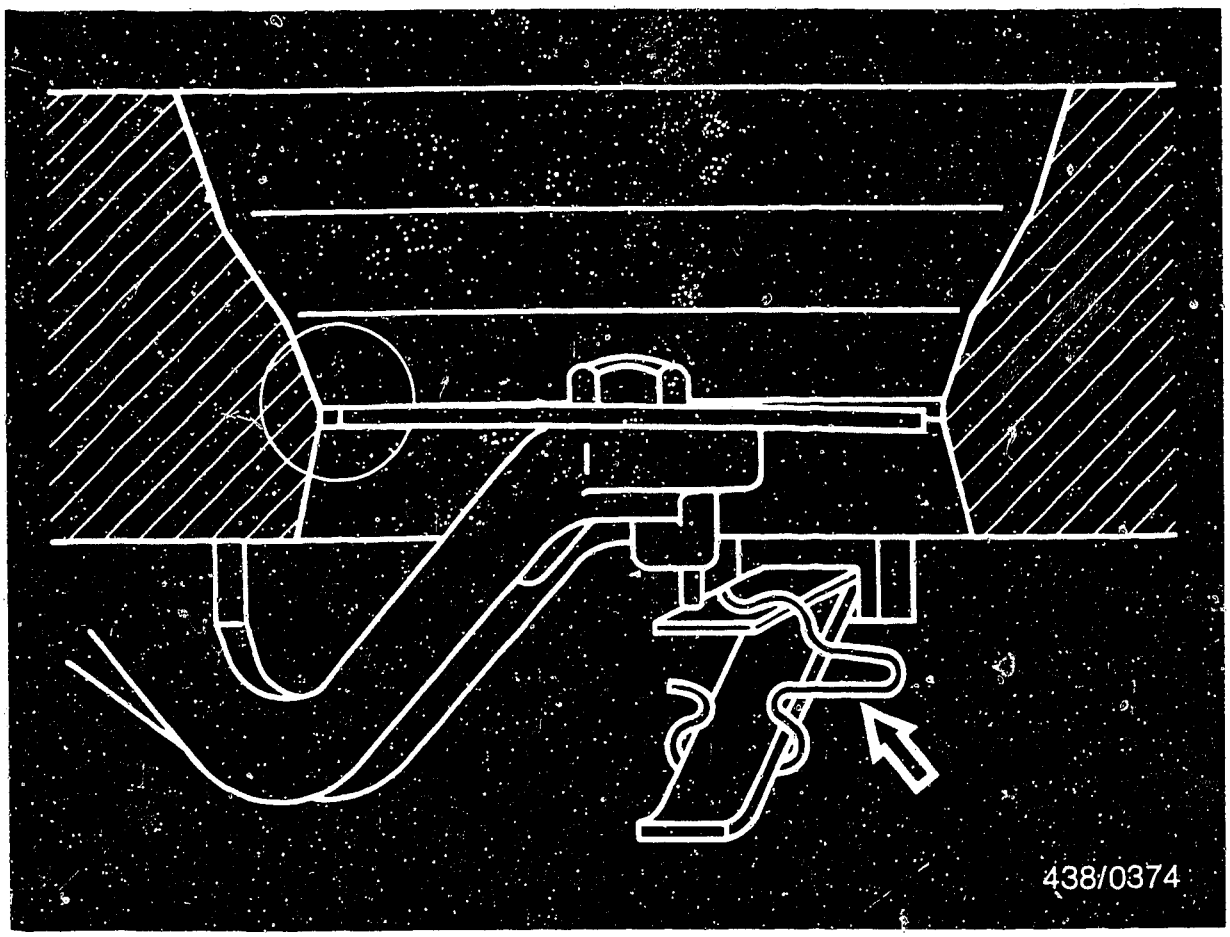
Check that the sensor plate is flat (not bent) and that it can move through the narrowest part of the air funnel without touching the funnel. If necessary, center it using a positioning ring KDEP 1040/10 (dia. 80 mm) as follows:

Loosen the sensor plate fastening screw. Insert the positioning ring while holding the fastening screw with pliers so that the sensor plate does not deflect downwards.



With the positioning ring in place, tighten the fastening screw with a torque of 5.0...5.5 Nm, loosen again and tighten again with the same torque.
When tightening the screw make sure that the air-flow sensor plate is in its zero position (in the cylindrical part of the air funnel).

It must no longer be possible to turn the air-flow sensor plate by hand.

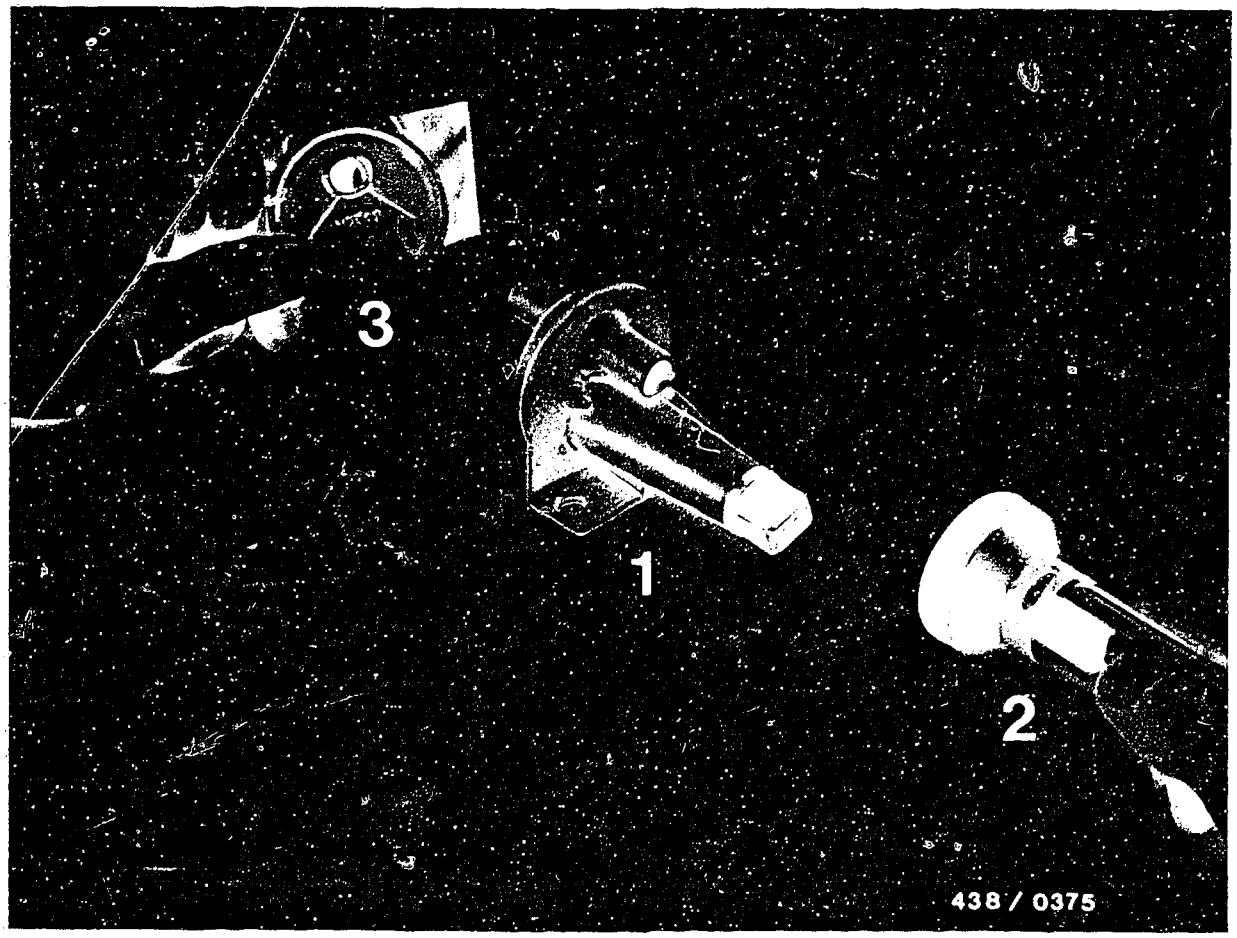


10.3 Checking and adjusting the zero position of the sensor plate (rest position):

Switch on the electric fuel pump for approx. 10 seconds by bridging the safety circuit.
This results in application of the control pressure to the control plunger in the fuel distributor.

The upper edge of the sensor plate must be flush with the cone in the position marked with a circle in the picture. A lower position of up to maximum 0.5 mm is permissible, however the air-flow sensor plate must not project at any point on its circumference outside the cylindrical part of the air funnel.

If necessary, the position of the leaf-spring limit-stop can be corrected by adjusting the shaped spring (arrow).



1 = Auxiliary-air device
2 = Flashlight
3 = Mirror

11. Checking the operation of the auxiliary-air device.

The engine must be cold.
Disconnect the electric cable plugs from the auxiliary-air device and warm-up regulator.
Disconnect both air hoses from the auxiliary-air device.
Since the two hose fittings on the auxiliary-air device are located exactly opposite each other, a visual check can now be made to see if the blocking plate is partially open.
It will be easier to look through the auxiliary-air device with the aid of a flashlight and a mirror, as shown in the illustration.

- If an opening is not visible with the engine cold, replace the auxiliary-air device.

- Fit the electric cable plug on the auxiliary-air device.

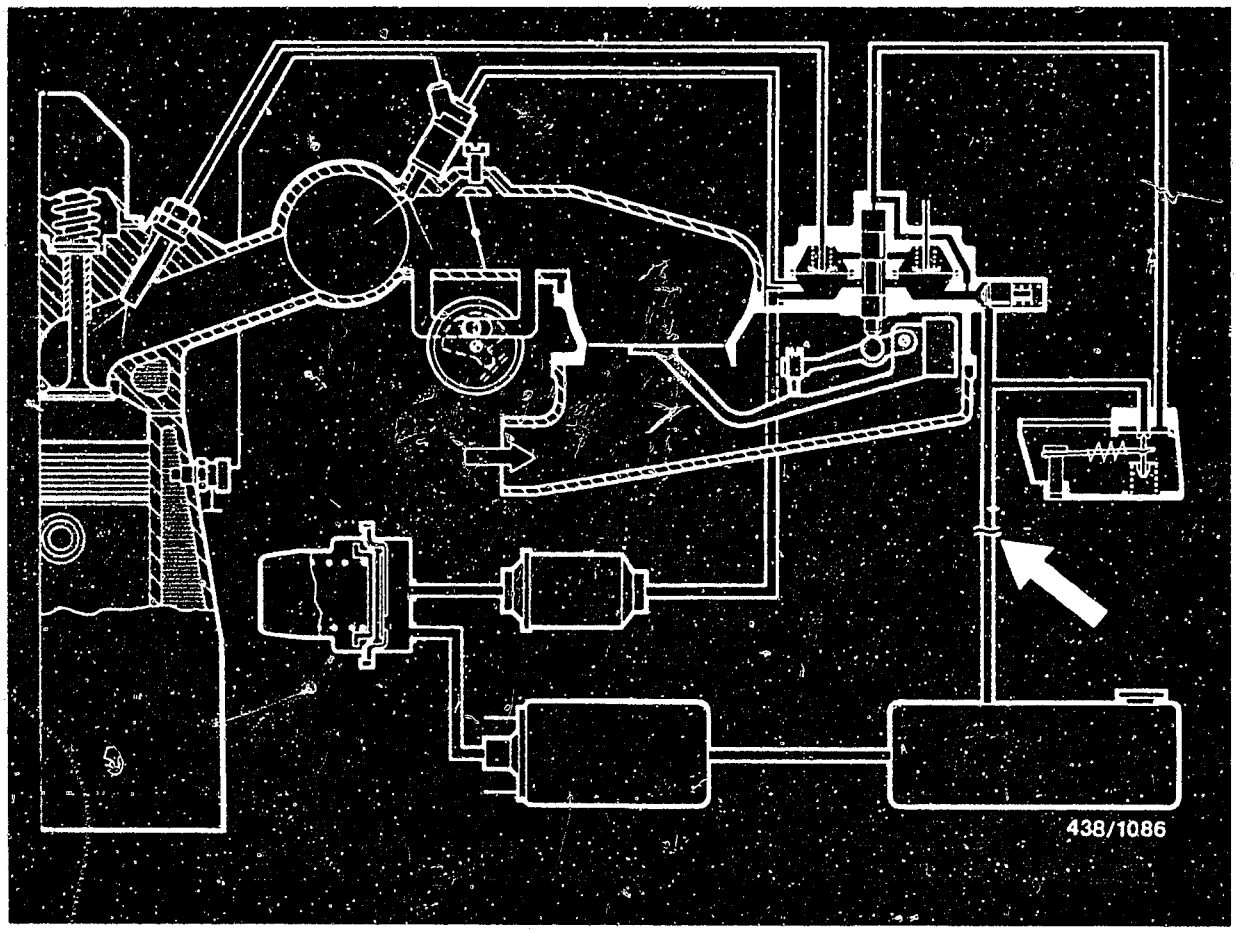
- By bridging the electrical safety circuit, supply power to the auxiliary-air device.
 After a maximum of 10 minutes, the opening in the auxiliary-air device must be completely closed by the blocking plate.

- If the blocking plate does not close, check the power supply (open circuit, voltage drop).
 Minimum voltage across the connector 11.5 V with the engine stopped.

- If these points are O.K., check the heating coil of the auxiliary-air device for an open circuit using an ohmmeter.

- Replace the auxiliary-air device if defective.

When the auxiliary-air device has been replaced, readjust the idle speed with the engine at normal operating temperature. Idle adjustment is described on Coordinates F 1.

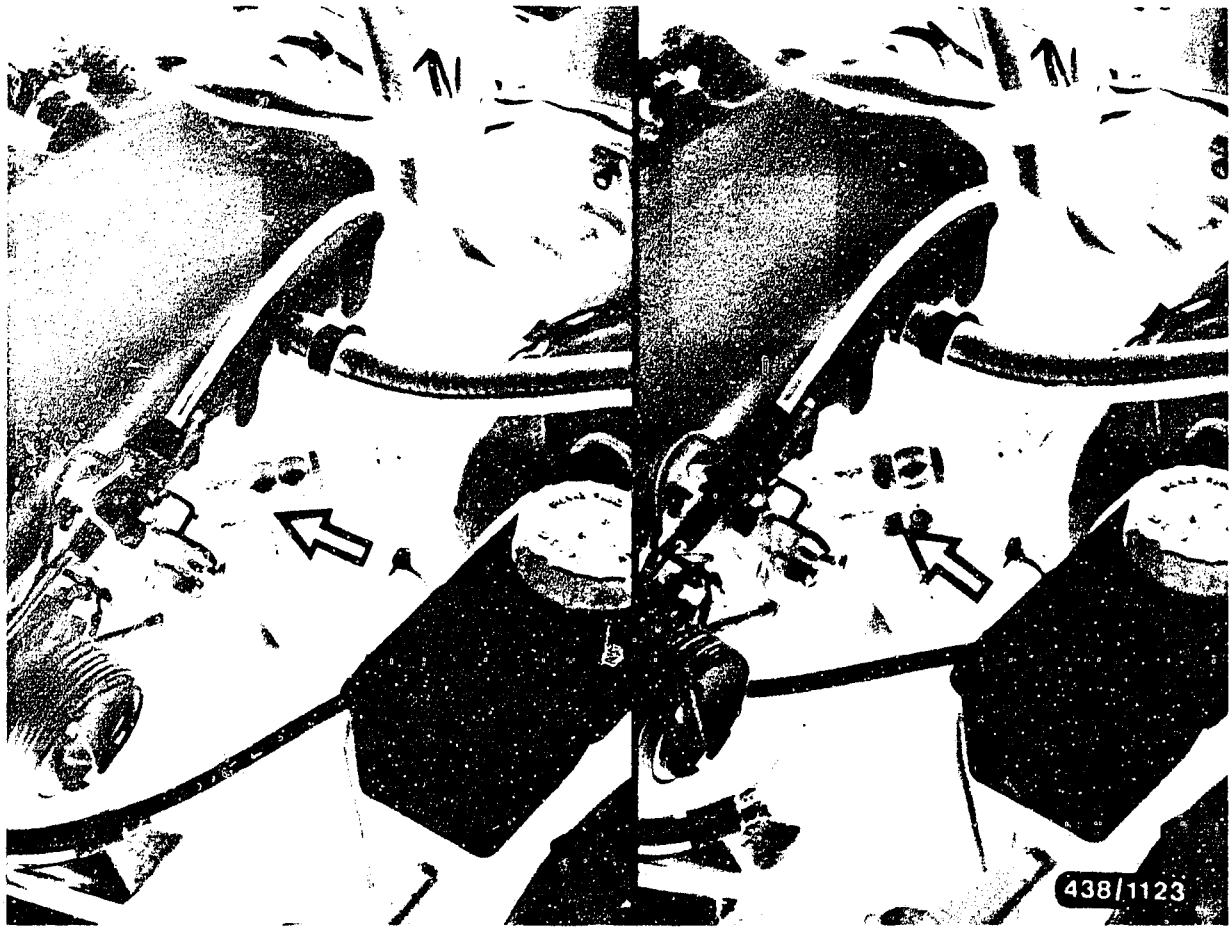


12. Checking the electric fuel pump

12.1 Test conditions

Conclusive information on the operation of the electric fuel pump can only be provided by measuring the fuel delivery under pressure, i.e. under primary pressure.

Therefore, this test must be performed at the return line to the fuel tank after the coming together of the return lines from primary-pressure regulator and warm-up regulator (arrow).



12.2 Measuring point

The measuring point is the return connection at the fuel distributor (left, arrow).

Equip the test hose with an inlet union (connection diameter 12 mm).

Unscrew double inlet-union screw from return connection and connect test hose instead of the (thicker) return line together with the return line from the warm-up regulator (right, arrow).

12.3 Testing

Remove the plugs from the warm-up regulator and auxiliary-air device.

Switch on the electric fuel pump for precisely 30 seconds by bridging the safety circuit and measure the delivery in a graduate.

C A U T I O N !

Never depress (deflect) the air-flow sensor plate with the electric fuel pump operating since otherwise fuel will be injected. Subsequent operating of the starting motor may lead to serious damage.

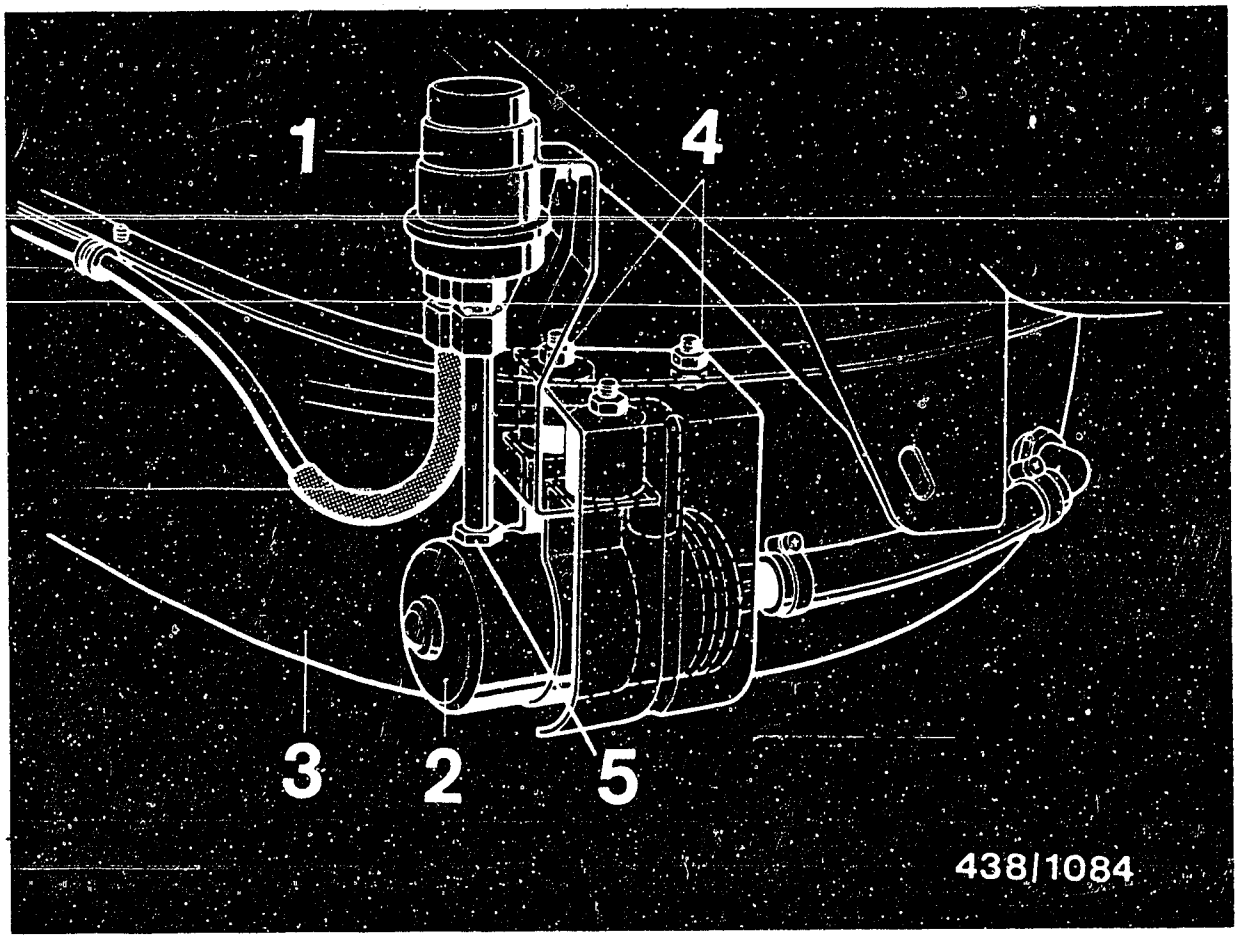
12.4 Test specification

Fuel delivery: min. 960 cm^3/30 seconds

12.5 Possible causes of insufficient fuel delivery:

- Power supply to the electric fuel pump defective, voltage drop.
 Necessary minimum voltage at terminal = 11.5 V
- Fuel filter very dirty.

If the above-mentioned points are O.K., the cause lies with the electric fuel pump itself.
Replace the electric fuel pump.



1 = Fuel accumulator
2 = Electric fuel pump
3 = Fuel tank
4 = Fastening nuts of bracket
5 = Delivery fitting

12.6 Removing and installing the electric fuel pump

Pinch off the intake hose before loosening (e.g. using hose clamper W 157 from Matra Co.) to prevent the escape of fuel.

Remove the complete bracket with electric fuel pump and fuel accumulator.

Unscrew delivery line from fuel accumulator and remove electric fuel pump from bracket.

Note:
Changing the electric fuel pump requires a new delivery line to the fuel accumulator.
This calls for a new 45 mm long piece of polyamide line, 8 mm inside diameter, for pressures of at least 25 bar.

Cut open the old line in the region of the delivery fitting (non-return valve) and of the screw nipple using a soldering iron and pull off.

C A U T I O N !

Do not use an open flame for heating the line.

Danger of fire !

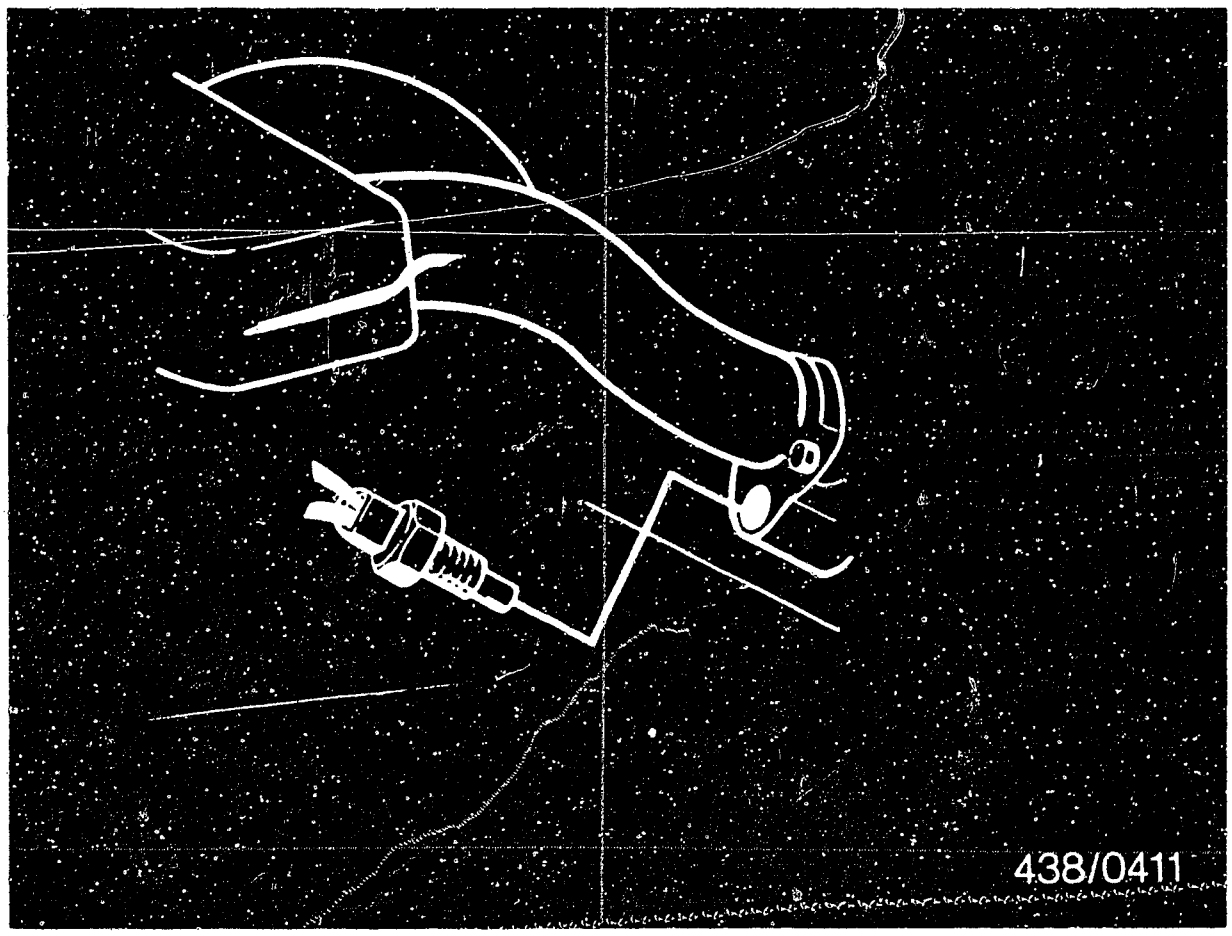
It is also not advisable to cut open the line using a knife because this will damage the toothed section of the fittings.

Insert new hose line into assembly tool KDEP 1039 so that it projects by the amount of the length of the nipple. Clamp the assembly tool in a vice and knock the screw nipple cold into the line using a clean plastic mallet.

Clamp the other end of the delivery line in the same manner in the assembly tool and press cold onto the delivery fitting of the electric fuel pump.
Hold the electric fuel pump when doing this - do not clamp in vice.

Important:
Do not heat the line for pressing on since it will undergo permanent expansion, which will lead subsequently to leaks.

Reinstall the electric fuel pump.
Remove the hose clamper from the intake line and, finally, check all connections for leaks with the electric fuel pump operating.

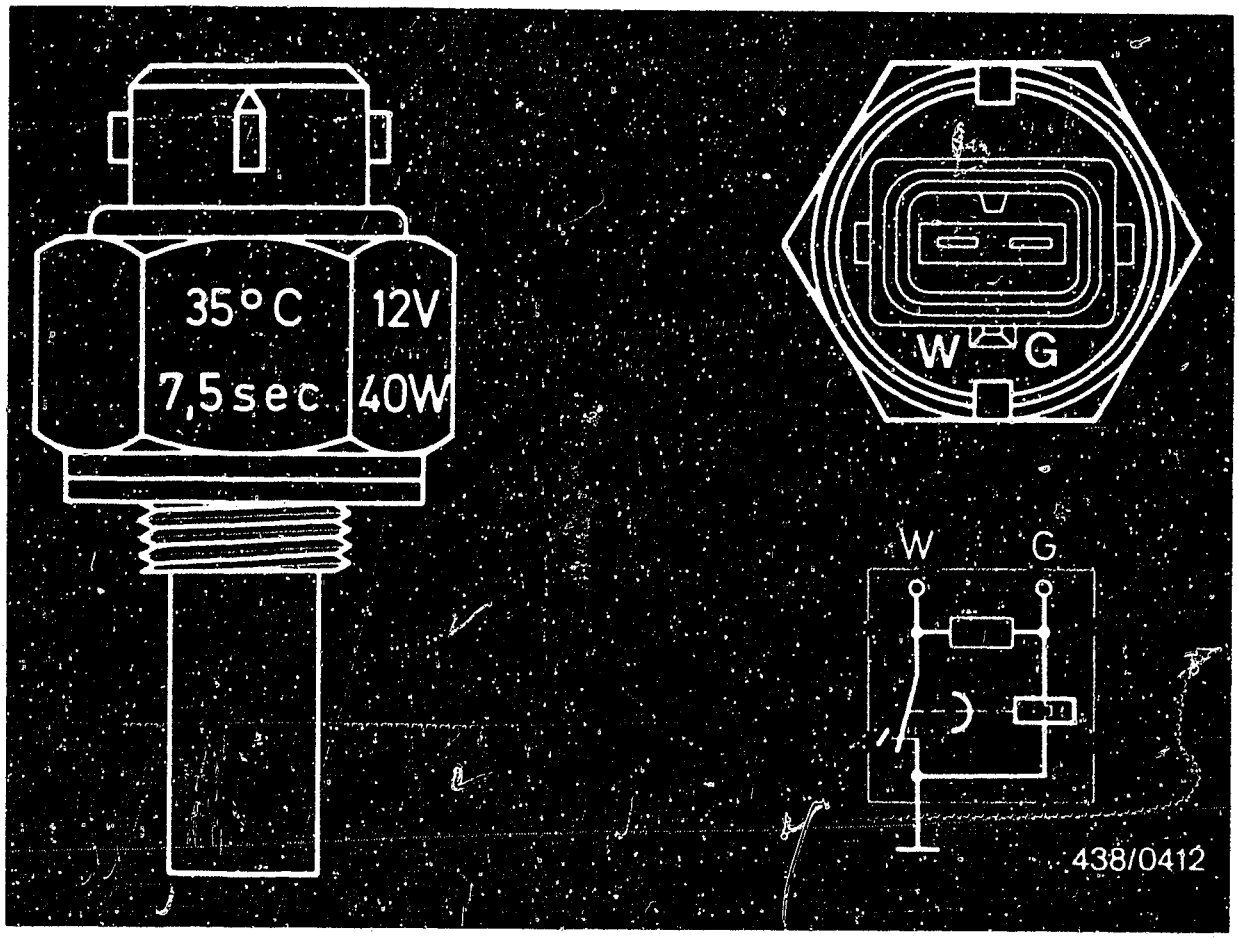


13. Testing the cold-starting system (thermo-time switch, start valve)

13.1 Thermo-time switch:

Remove the thermo-time switch for testing. It is screwed into the flange of the air-inlet port of cylinder 4 on the cylinder head.

Caution:
If possible, remove only when the engine is cold since a small amount of coolant will escape. The amount of coolant escaping would be considerably greater if the engine were hot.



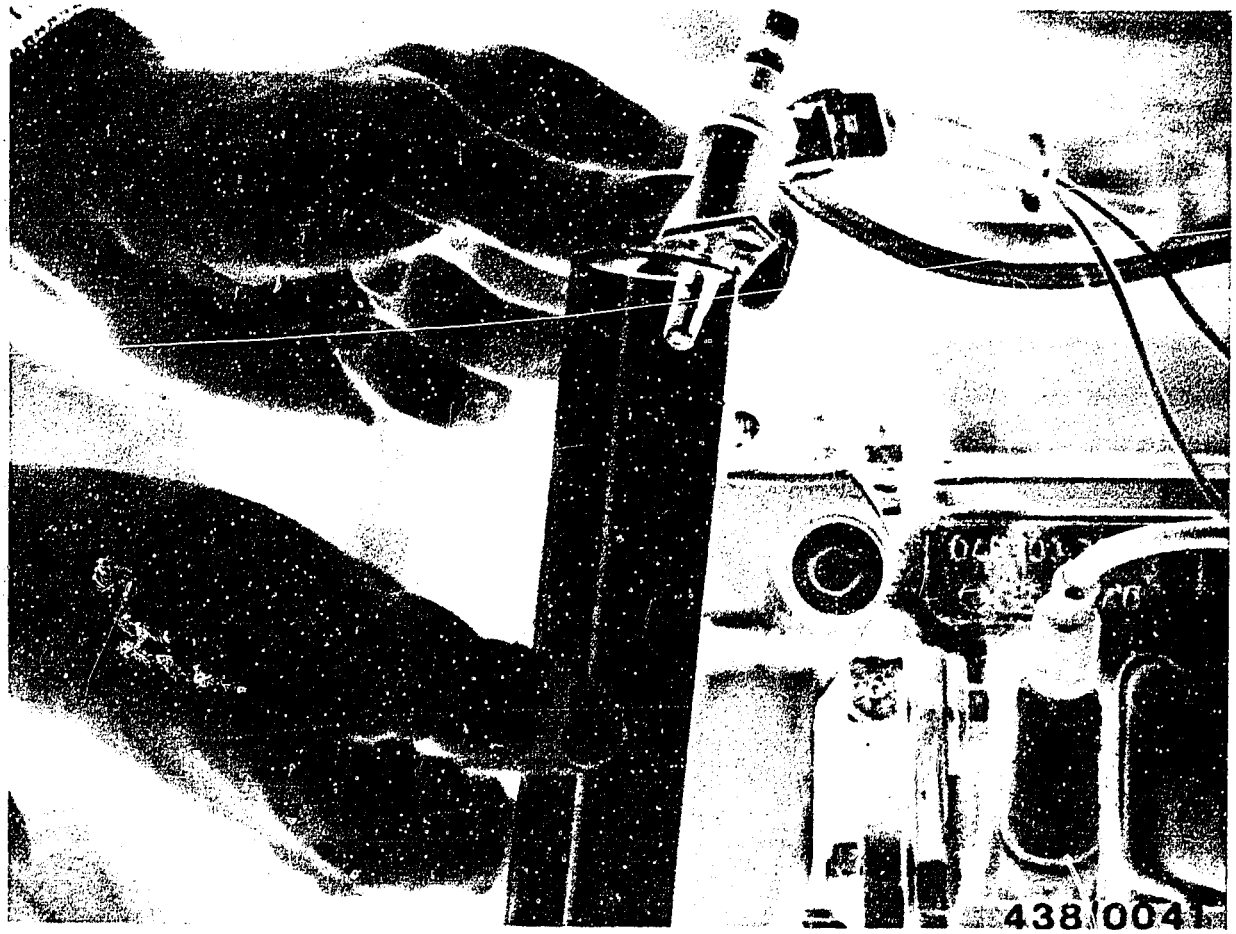
The thermo-time switch used in the Volvo (not a Bosch product) has a switching temperature of 35°C and a switching time at -20°C of 7.5 seconds. Both values are marked on the hexagonal section of the thermo-time switch.

The removed thermo-time switch is tested using an ohmmeter in accordance with the values given below.

The temperatures for the thermo-time switch can easily be obtained with water. Cooling takes place in a freezer chest.

Resistance measurement (Ω) between

At a temperature below °C	above °C	Term. "G" and "ground" (housing)	Term "W" and "ground" (housing)	Term "G" and term. "W"
+30		25...40 Ω	0 Ω	25 ... 40Ω
	+40	50...80 Ω	100...160 Ω	50 ... 80Ω



13.2 Start valve:

Remove the start valve. Hose line remains connected. Pull off the plug and connect the start valve directly to ground and to terminal 15 (e.g. at the ignition coil) using connecting cable KDJE 7450/70.

Important note:
During this test, do not let the connecting cable touch B +. Danger of fire due to sparking!
Hold the start valve in a suitable container (e.g. the graduate).

Switch on the electric fuel pump by bridging the safety circuit.
Switch on the ignition (max. 30 seconds). The start valve must now open and spray fuel.

Switch off the ignition, remove the electric connecting cable and dry the nozzle of the start valve.
The safety circuit remains bridged so that the primary pressure is applied to the start valve.
No droplets of fuel must drip from the nozzle of the start valve during the next minute. Even if shaken and knocked, the start valve must not leak.
Then switch the electric fuel pump off again.
Replace the start valve if it does not open or if it leaks.

If a leaky start valve or a defective thermo-time switch has been replaced, it is necessary finally to adjust the idle speed with the engine at normal operating temperature.

Idle adjustment is described as of Coordinate F 1.

14. Checking the control pressures

14.1 Preliminary remarks:

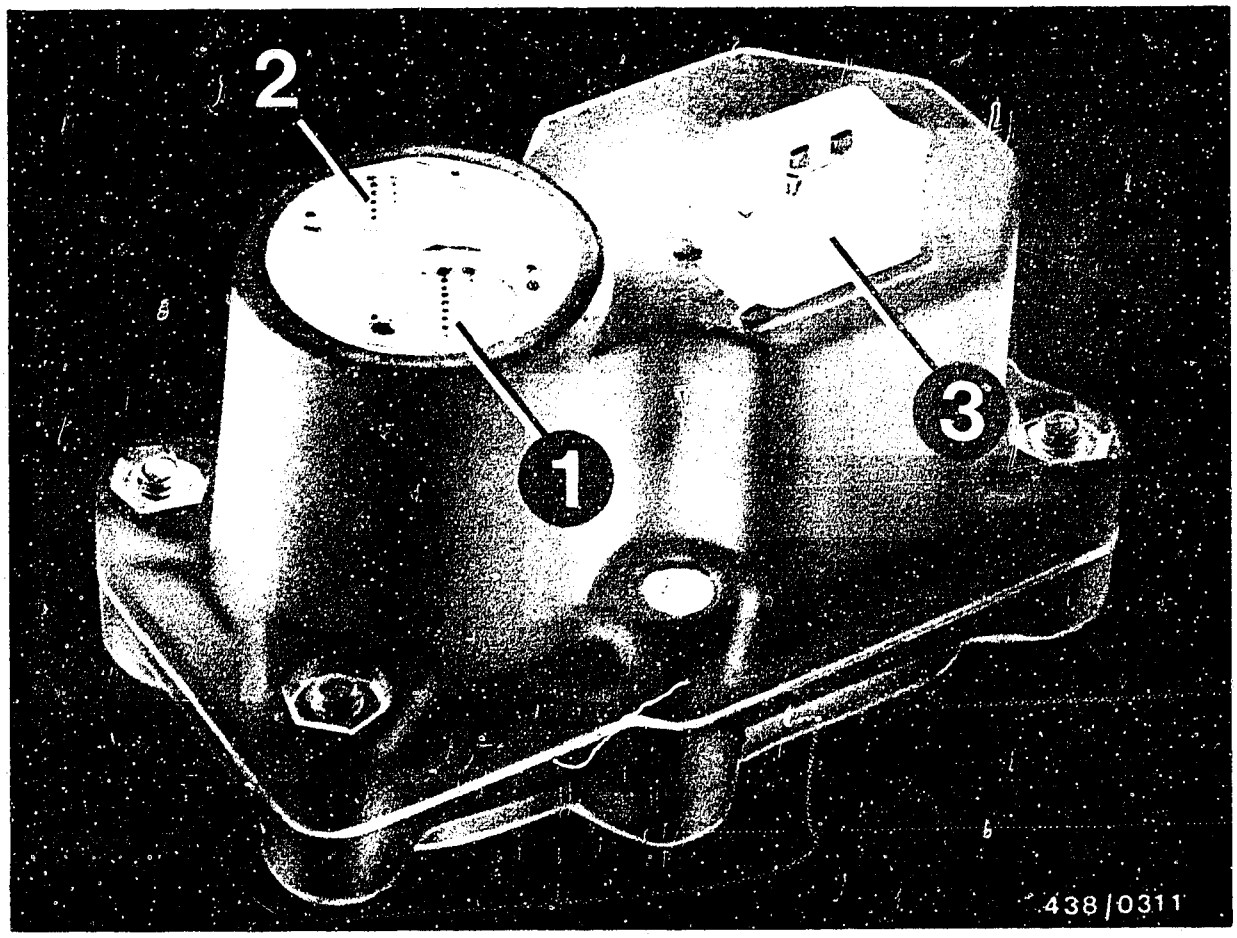
The control pressures tested in the following are in each case governed by the warm-up regulator.
If the test results are incorrect, however, this may also be due to faults which have nothing to do with the warm-up regulator.

These possible faults are:

- No or too low a voltage at the electric connector.
- Fuel return from the warm-up regulator blocked or constricted.
- Too high a fuel delivery for the control-pressure circuit.

The testing of this control-pressure delivery is described as an additional test step at the beginning of the control pressure tests.
Test specification: 160...240 cm^3/min.

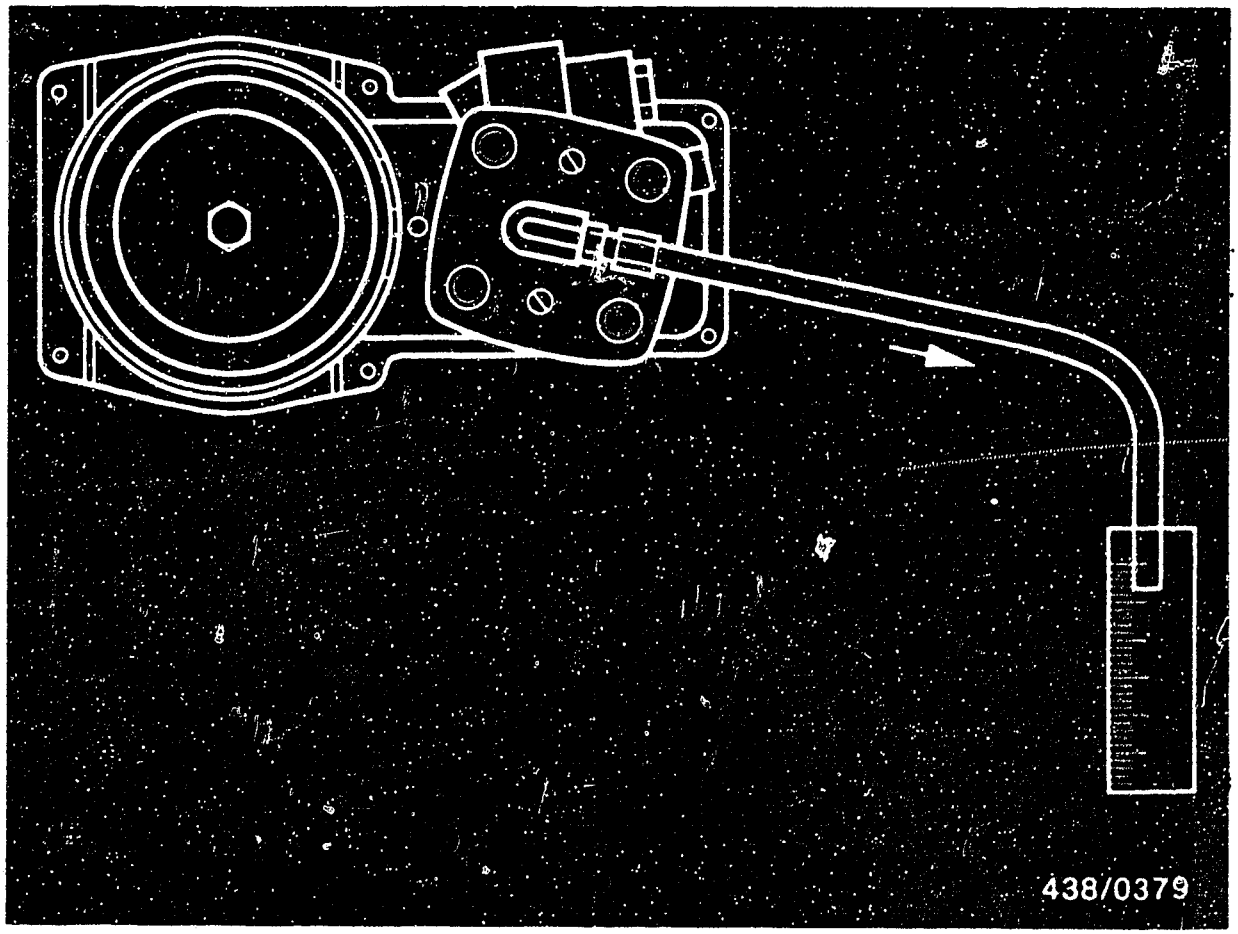
Reference is made to the other possible causes of trouble in the respective test step.



1 = Intake port (M 10 x 1)
2 = Return port (M 8 x 1)
3 = Electrical connection

14.2 Design of warm-up regulator

The warm-up regulator corresponds to the standard design, i.e. apart from control pressure "cold" and "warm" no other functions (such as full-load and altitude compensation) are performed.



14.3 Checking the fuel delivery for the control-pressure circuit:

Before testing: Make sure that the electric fuel pump is operating properly. Test specification: min. 750 cm^3/30 s.

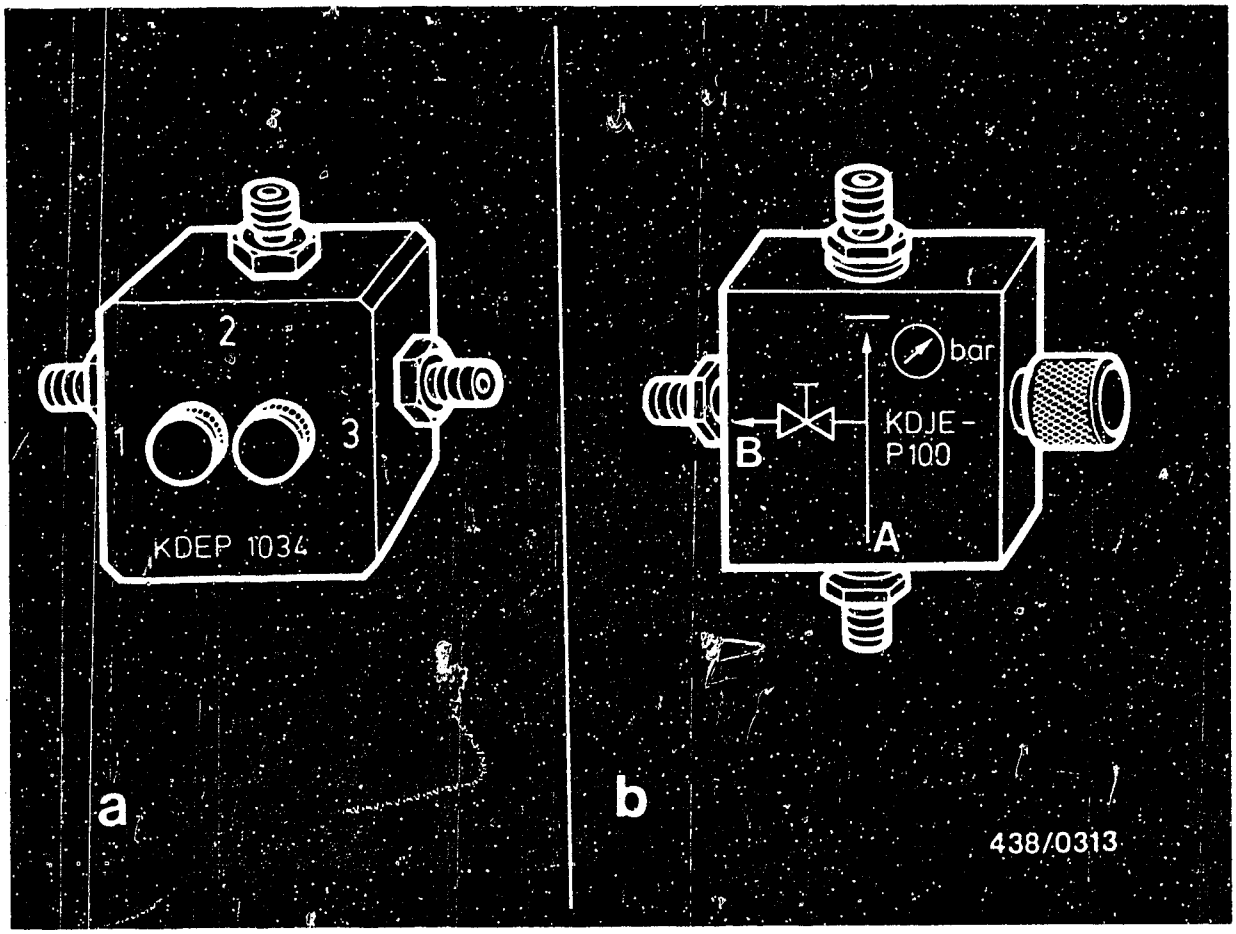
Unscrew the control-pressure line (to the warm-up regulator) from the fuel distributor.

Screw connecting piece (thread M 8 x 1/M 12 x 1.5) from connecting parts set KDJE-P 100/10 onto control-pressure port. Connect one of the two connecting hoses of the pressure tester KDJE-P 100 (previously KDEP 1034) to the connecting piece on the fuel distributor (thread M 12 x 1.5) and hold hose in graduate (approx. 0.5 litre capacity).

Switch on the electric fuel pump for 1 minute by bridging the safety circuit.
Measure delivery.

Test specification: 160...240 cm^3/min.

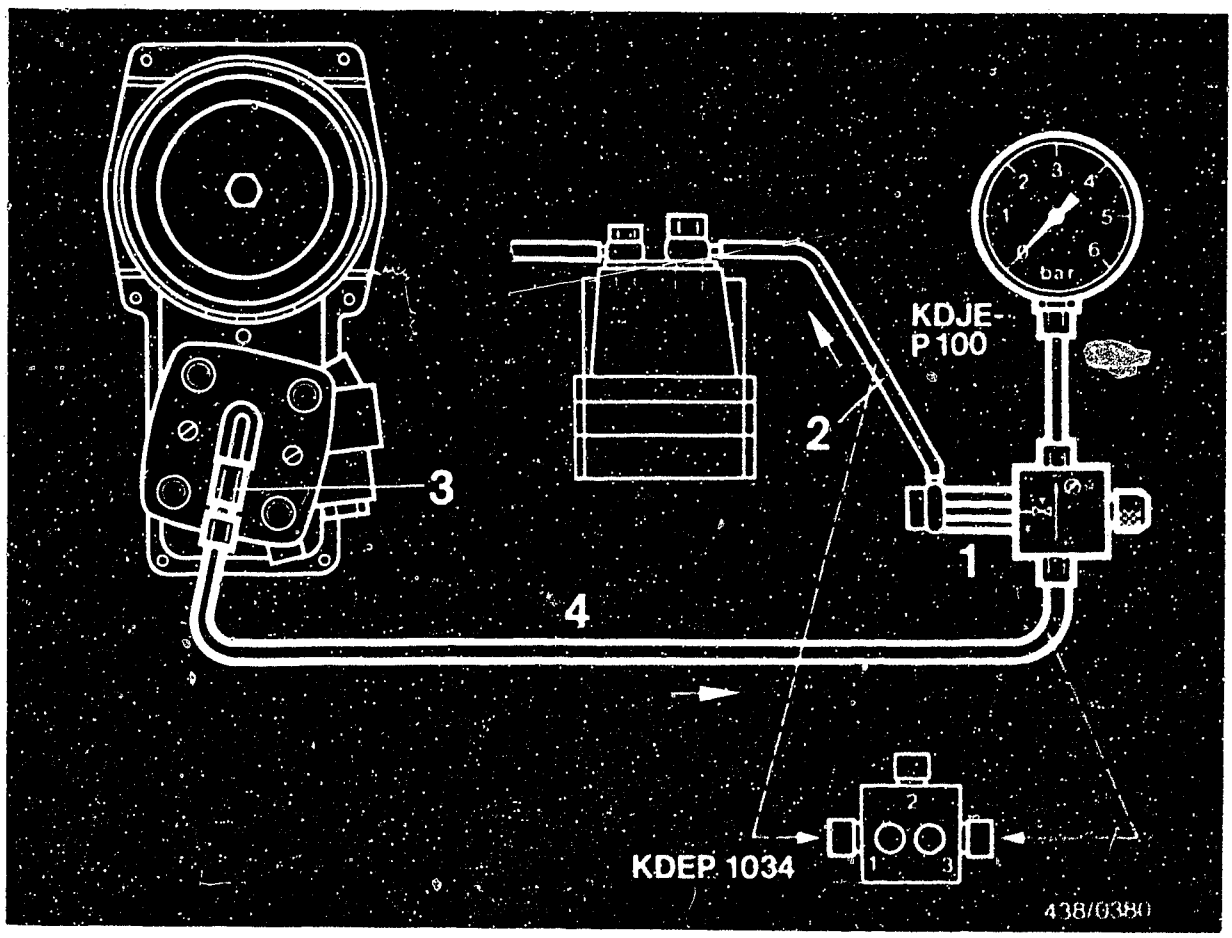
If the measured value is outside tolerance, the fault is in the fuel distributor.
Replace the fuel distributor.



14.4 Mounting the pressure tester KDJE-P 100 (formerly KDEP 1034):

The pressure tester KDEP 1034 is equipped with a three-way valve with 2 separate valve screws. The connections of the directional-control valve are numbered (Fig. a). Since the end of 1979 the pressure tester KDJE-P 100 has been supplied. Its directional-control valve has only one valve screw (Fig. b). The connections of this directional-control valve are identified by symbols:
A = Inlet (from the fuel distributor)
B = Outlet (to the warm-up regulator)

Caution:
When the directional-control valve is not in use, always keep the valve screw(s) open in order to relieve the pressure on the seal rings.



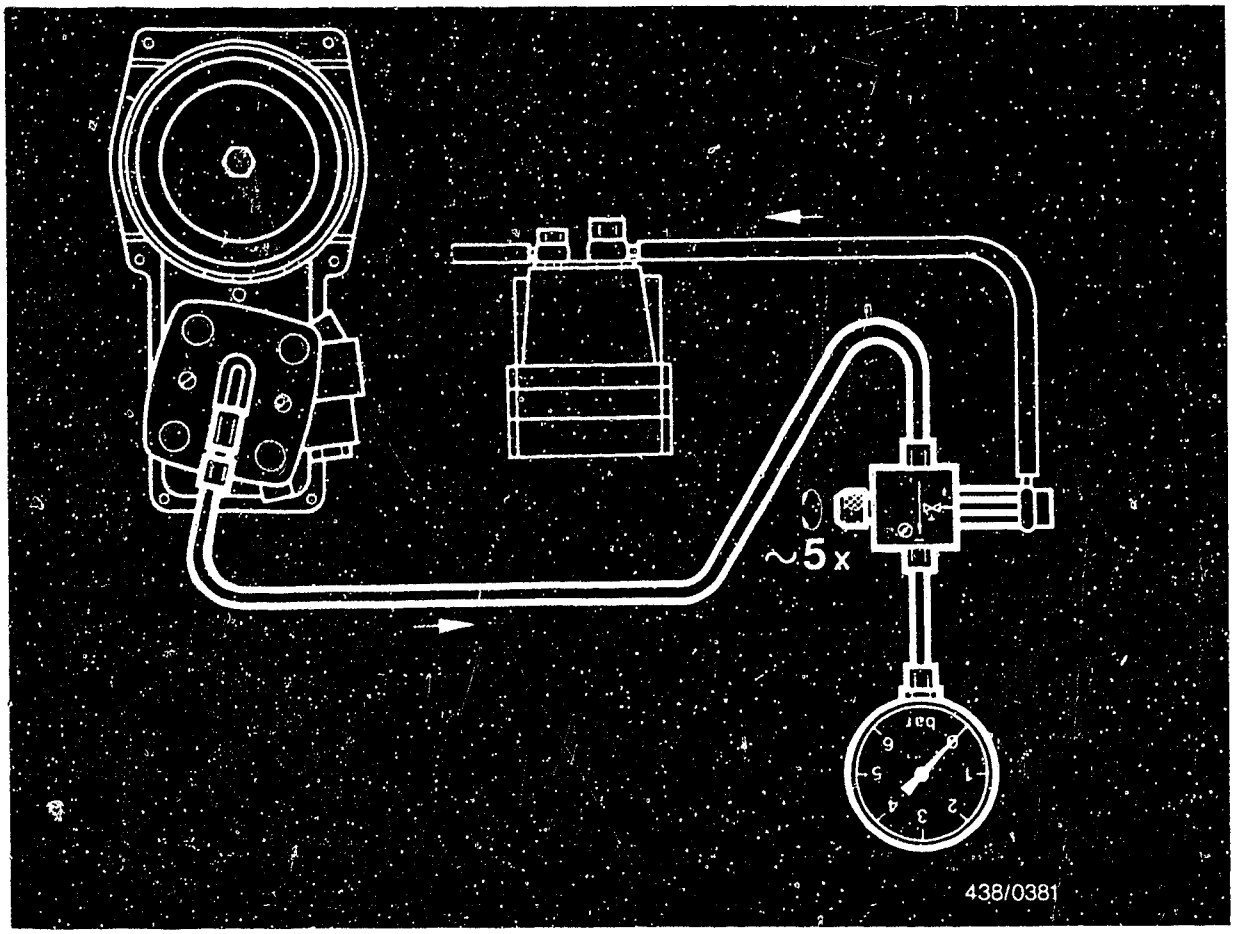
The directional-control valve of the pressure tester is connected into the control-pressure line from the fuel distributor to the warm-up regulator.

Fitting is carried out using connecting-parts set KDJE-P 100/10.

Screw the adapter from the connecting parts set with a sealing ring onto connection B or 1 of the directional-control valve (1).

Unscrew the control-pressure line (to the warm-up regulator) from the fuel distributor and connect it to the adapter (2).

Screw the connecting part of the connecting-parts set to the control-pressure connection of the fuel distributor (3) and connect it to connection A or 3 of the directional-control valve via a hose (4).



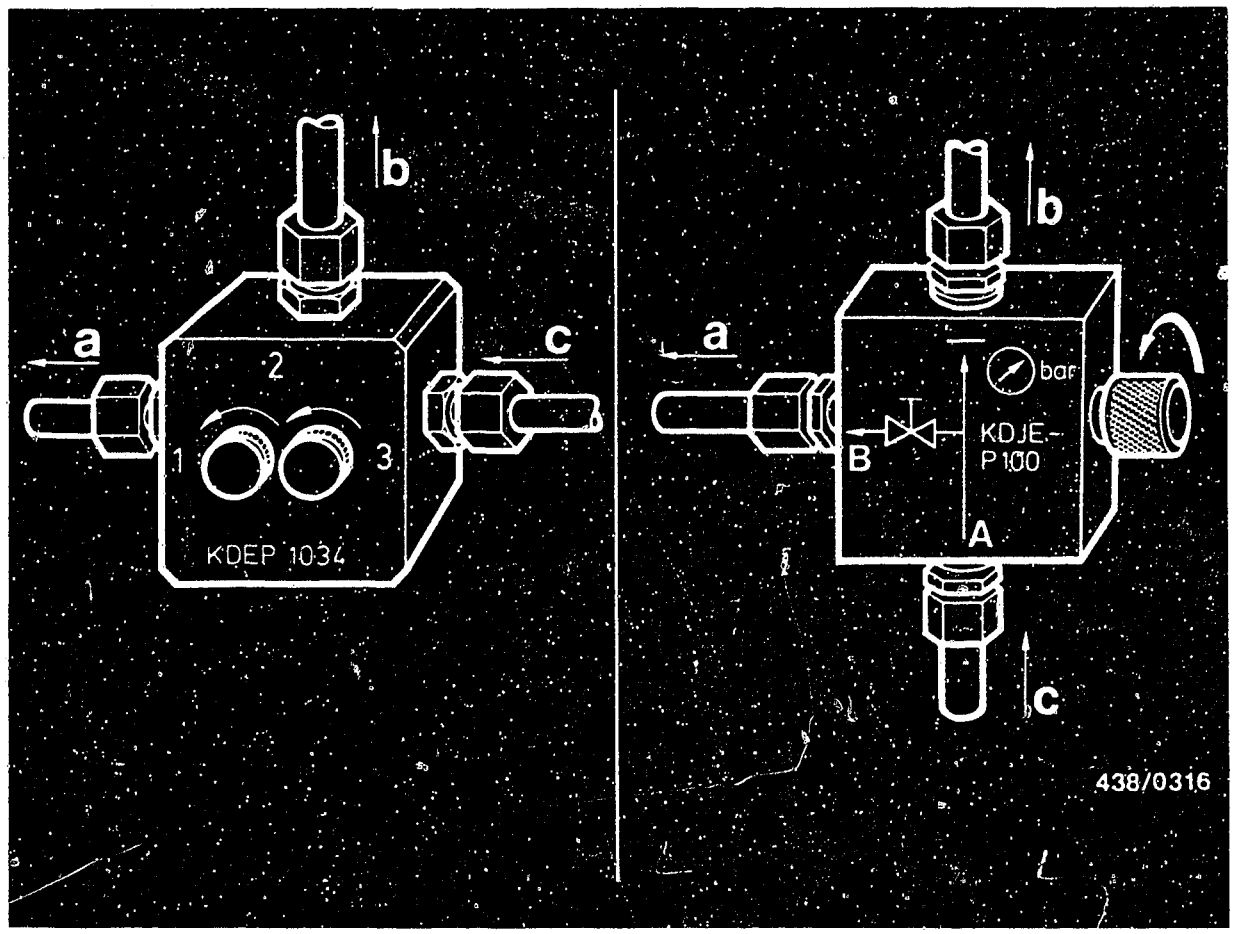
14.5 Bleeding the pressure tester

Disconnect the electric plug from the warm-up regulator. Let the pressure gauge hang down (hose fully extended).

Switch on the electric fuel pump by bridging the electrical safety circuit.

Open and close the valve screw(s) of the directional-control valve in a 10-second rhythm about 5 times.

Then hang the pressure gauge from a suitable support (e.g. from one of the struts under the engine hood). Open valve screw of directional-control valve (both screws in the case of KDEP 1034) (turning to the left).

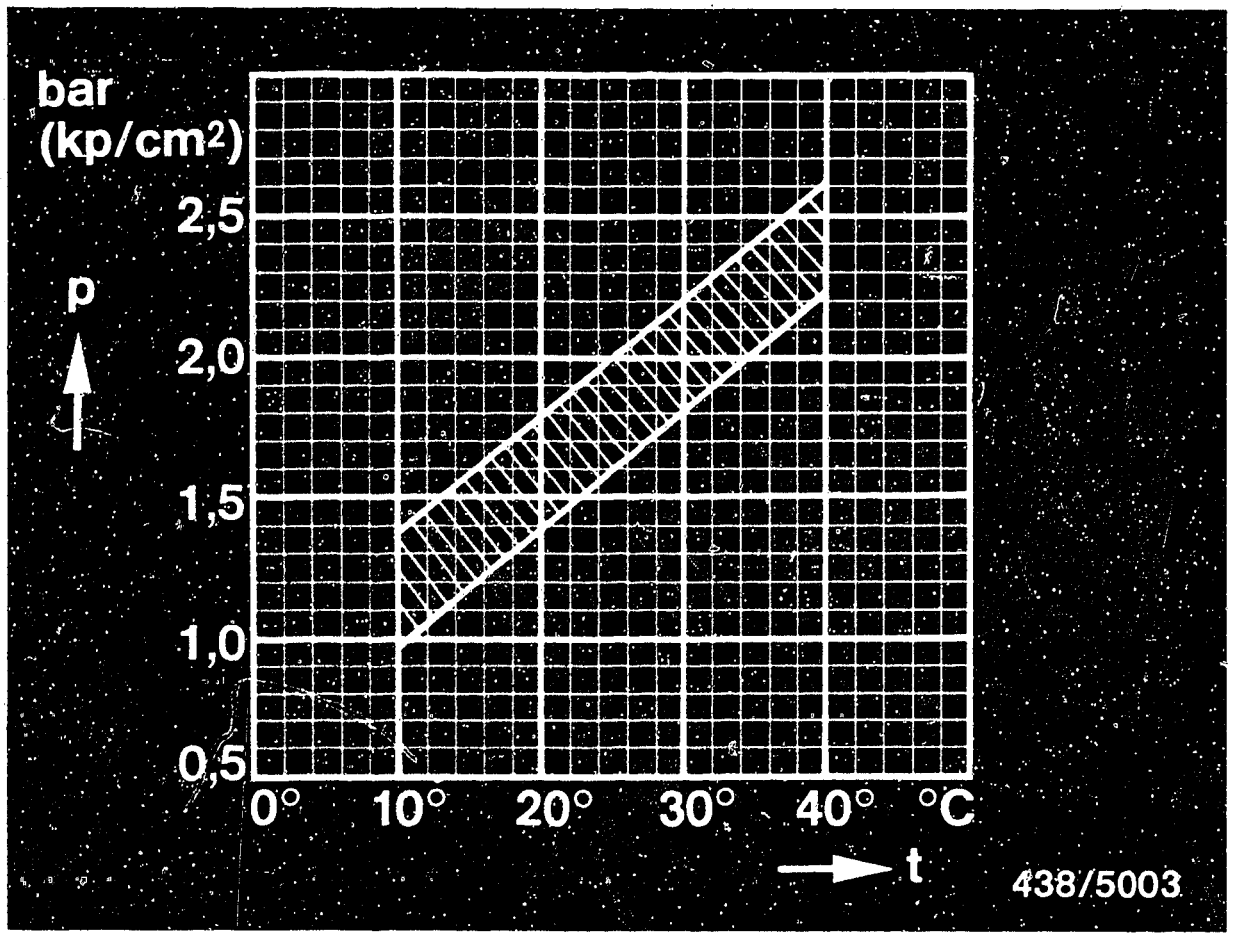


a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

14.6 Testing the "cold" control pressure:

Warm-up regulator: 0 438 140 004
.. 014

The test is performed with the engine switched off.
The engine must be cold. For this purpose, the engine should have been switched off for several hours, preferably overnight.
Pull off the plug from the warm-up regulator.
Open the valve screw of the directional-control valve (both screws in the case of KDEP 1034).
Switch on the electric fuel pump by bridging the electrical safety circuit.



p = Control pressure (bar or kgf/cm² gauge pressure)
t = Ambient temperature (°C)

Warm-up regulator Part No.: 0 438 140 004
.. 014

Calculate the nominal control pressure in accordance with the ambient temperatures in the graph.

Example: Ambient temperature = 20°C
Nominal control pressure = 1.4...1.8 bar gauge pressure

If the measured "cold" control pressure differs from the nominal value, this may be due to one of the following faults:

- Fuel delivery for the control-pressure circuit too low or too high. Test fuel delivery.

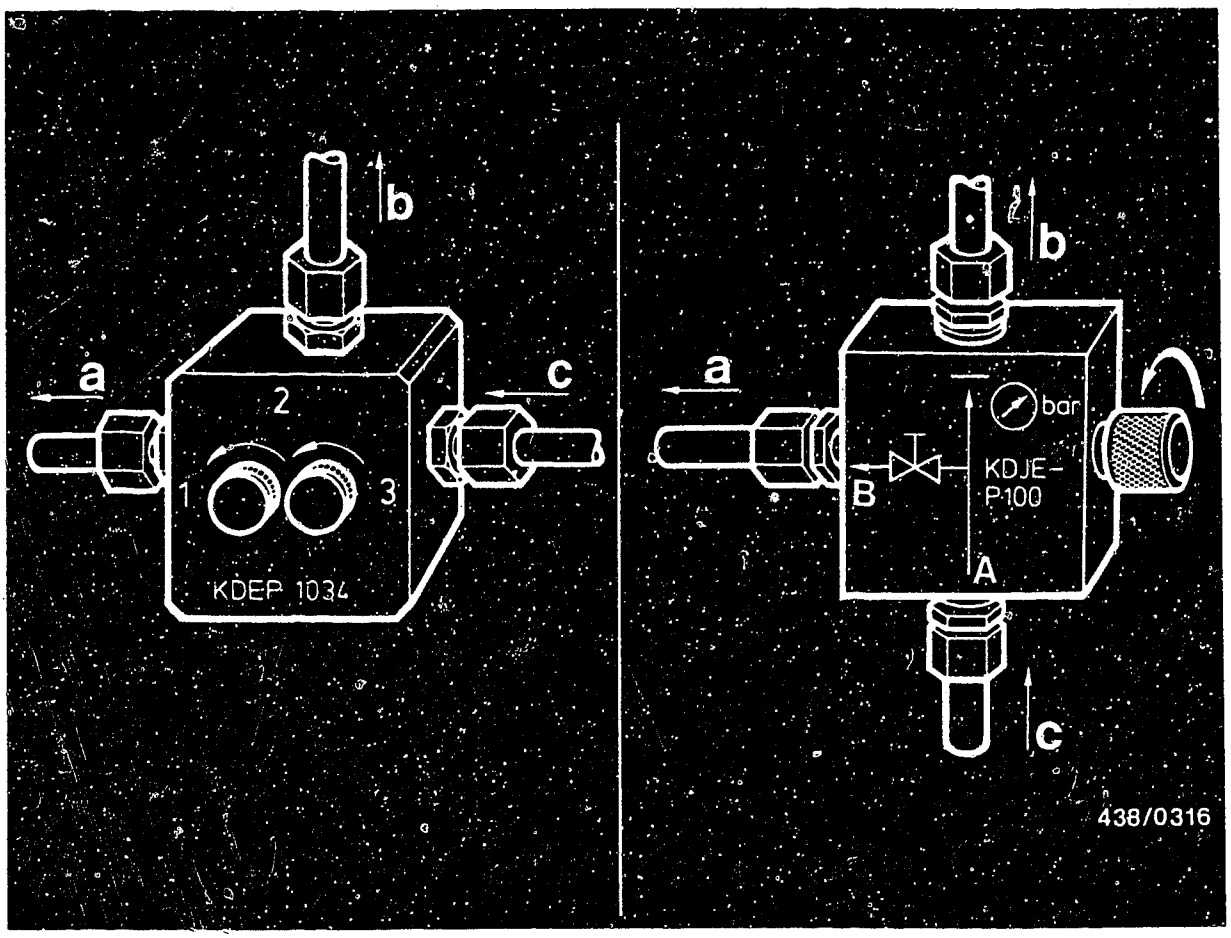
 Test value: 160...240 cm^3/min.

- Fuel return from warm-up regulator blocked or constricted (if control pressure too high).
 Eliminate restriction.

- Warm-up regulator defective.
 Replace warm-up regulator.

When the warm-up regulator has been replaced or a fault remedied, carry out the idle adjustment with the engine at normal operating temperature.

Idle adjustment is described on Coordinate F 1



a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

14.7 Testing the "warm" control pressure:

Warm-up regulator Part No.: 0 438 140 004
.. 014

The test is performed with the engine switched off.
The temperature of the engine is not important.

Open the valve screw of the directional-control valve (both screws in the case of KDEP 1034).

Switch on the electric fuel pump by bridging the electrical safety circuit.

Attach the plug to the warm-up regulator.

Control pressure now rises (the warm-up regulator in the process of shutting off) until the "warm" control pressure is reached.

Test specifications for "warm" control pressure:	3.4...3.8 bar gauge pressure (3.5...3.9 kgf/cm³ gauge pressure)

If the measured "warm" control pressure differs from the test specification, this may be due to one of the following faults:

If control pressure too high:

- Fuel delivery for the control-pressure circuit too high.
 Test fuel delivery.
 Test specification: 160...240 cm^3/min.

- Fuel return from the warm-up regulator blocked or constricted. Eliminate constriction.

- Warm-up regulator has hydraulic defect.
 Replace warm-up regulator.

If control pressure too low:

- Power supply open-circuit.
 Eliminate open circuit. Ensure that the plug is contacting properly.

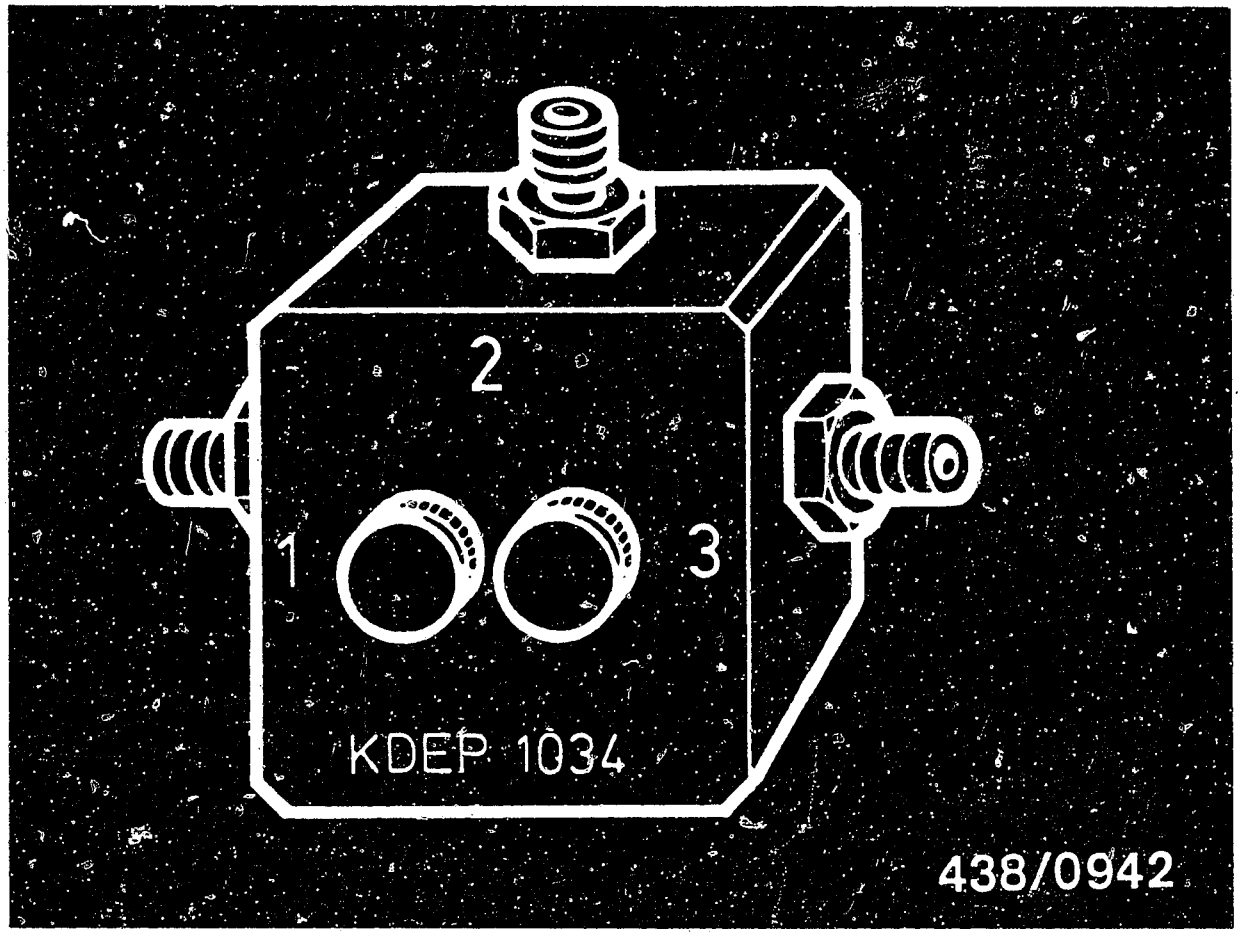
- Battery voltage too low, voltage drop.
 Eliminate voltage drop. Minimum voltage at connector: 11.5 V.
 If necessary, repeat test with engine running in order to obtain the normal generator voltage of approx. 14 V when the vehicle is in operation.

- Fuel delivery for the control-pressure circuit too low.
 Test fuel delivery.
 Test specification: 160...240 cm^3/min.

- Warm-up regulator defective. Heating coil open-circuit. Hydraulic defect. Replace warm-up regulator.

When the warm-up regulator has been replaced, or when a defect has been remedied, the idle speed is to be set finally with the engine at normal operating temperature.

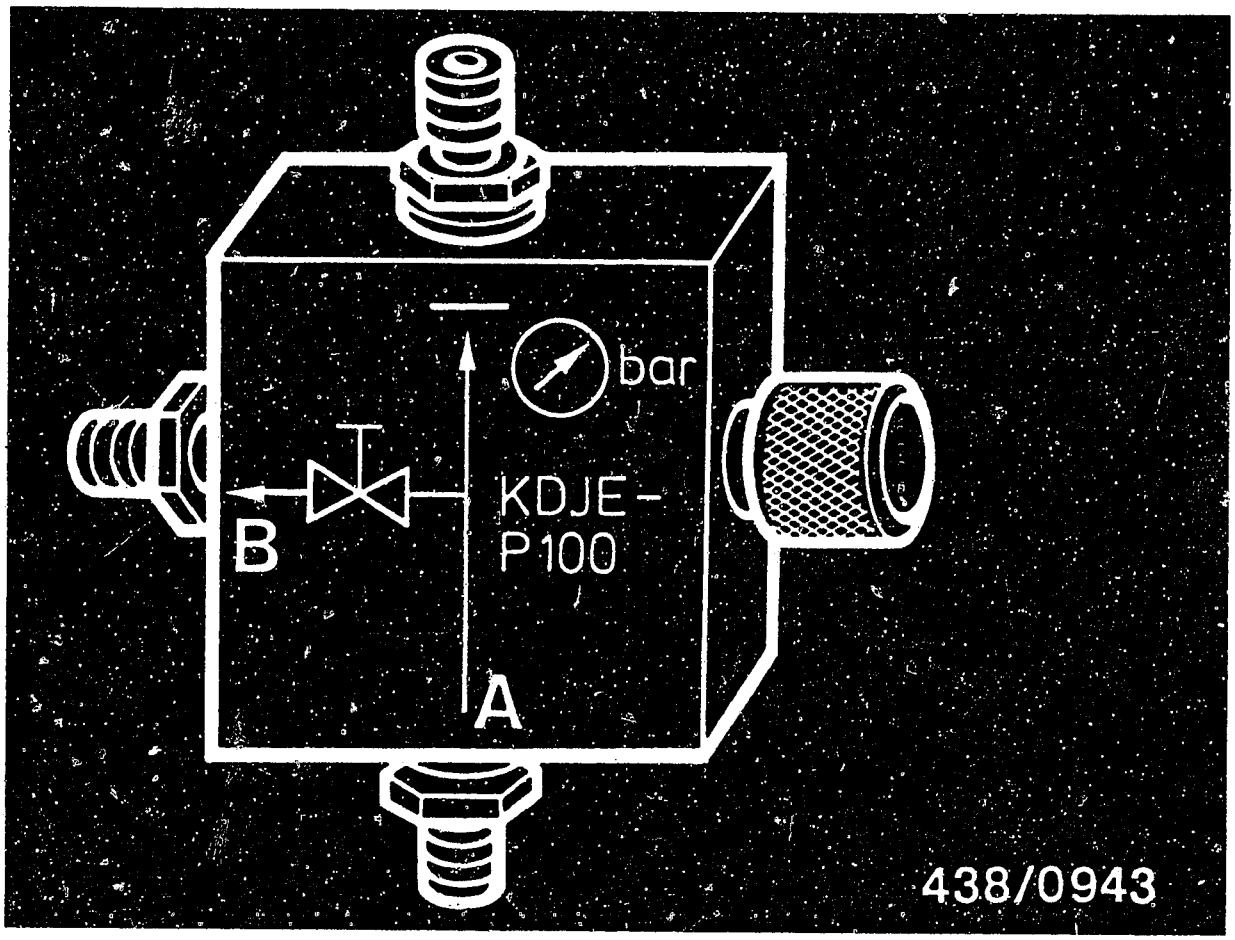
Idle-speed adjustment is described on Coordinates F 1 .



15. Testing and adjusting the primary (system) pressure:

15.1 Mounting the pressure tester KDJE-P 100 (formerly KDEP 1034):

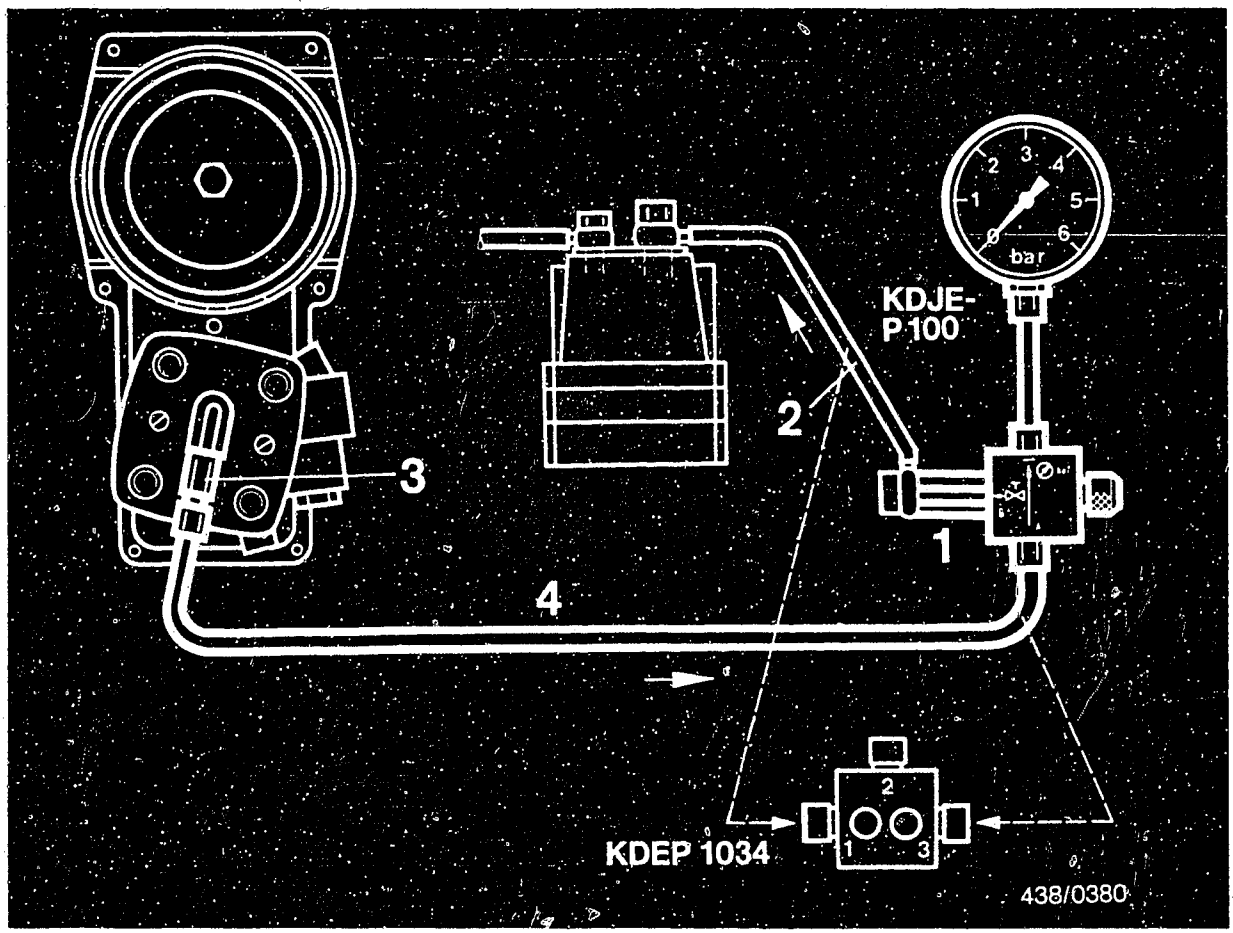
The pressure tester KDEP 1034 is equipped with a three-way valve with 2 separate valve screws. The connections of the directional-control valve are numbered (Fig. a).



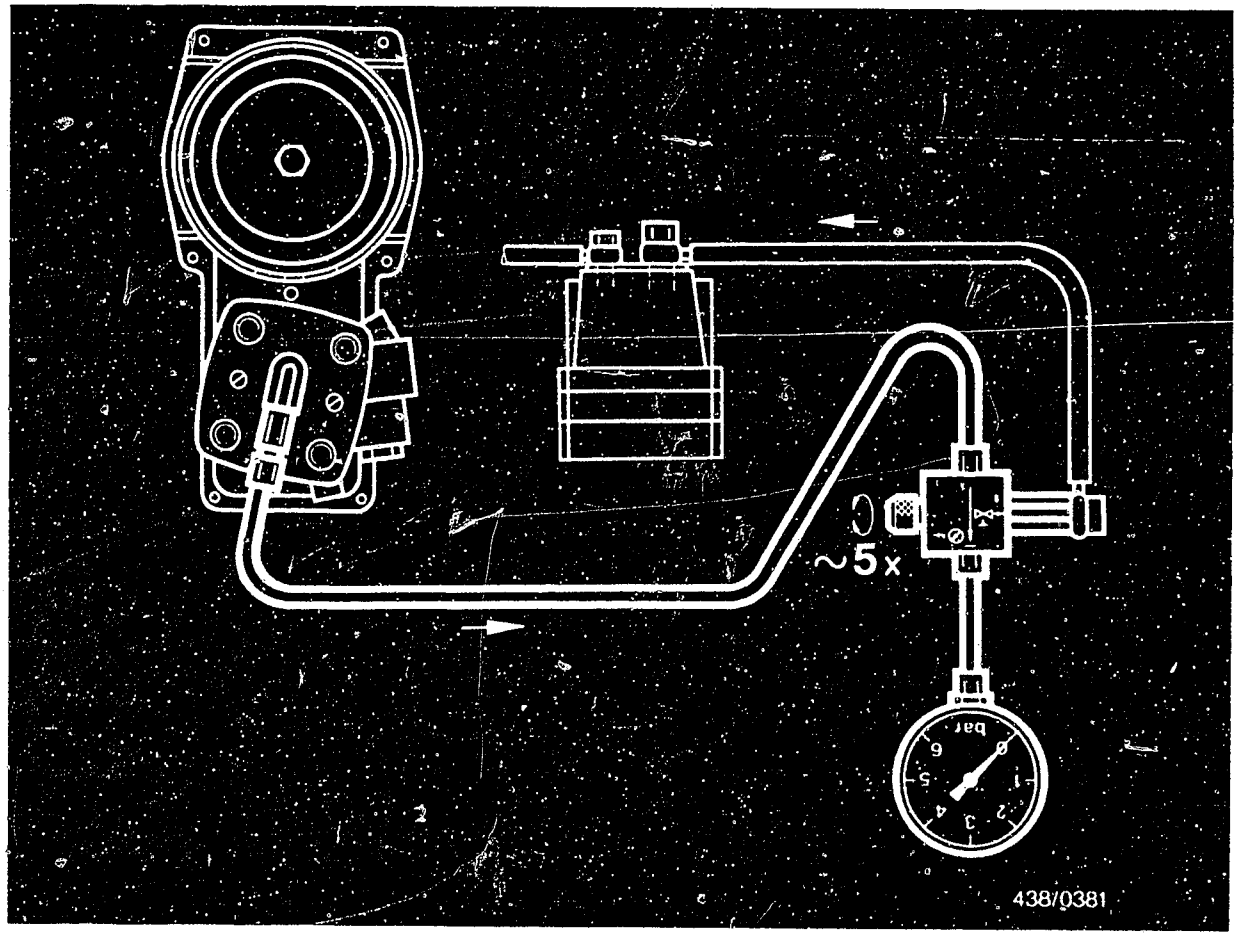
Since the end of 1979 the pressure tester KDJE-P 100 has been supplied. Its directional-control valve has only one valve screw (Fig. b). The connections of this directional-control valve are identified by symbols:

A = Inlet (from the fuel distributor)
B = Outlet (to the warm-up regulator)

Caution:
When the directional-control valve is not in use, always keep the valve screw(s) open in order to relieve the pressure on the seal rings.



The directional-control valve of the pressure tester is connected into the control-pressure line from the fuel distributor to the warm-up regulator.
The connecting-parts set KDJE-P 100/10 (previously KDEP 1034/10) is additionally required.
Screw the adapter (1) with seal ring to connection port B or 1 of the directional-control valve.
Unscrew the control-pressure line (2) from the fuel distributor and connect to the adapter by means of hollow screw M 8 x 1 and seal rings.
Screw connecting piece (3) of the connecting-parts set onto control-pressure connection port of the fuel distributor and connect with connection port A or 3 of the directional-control valve via connecting hose (4).
Then hang the pressure gauge from the engine hood (perhaps with a wire hook).



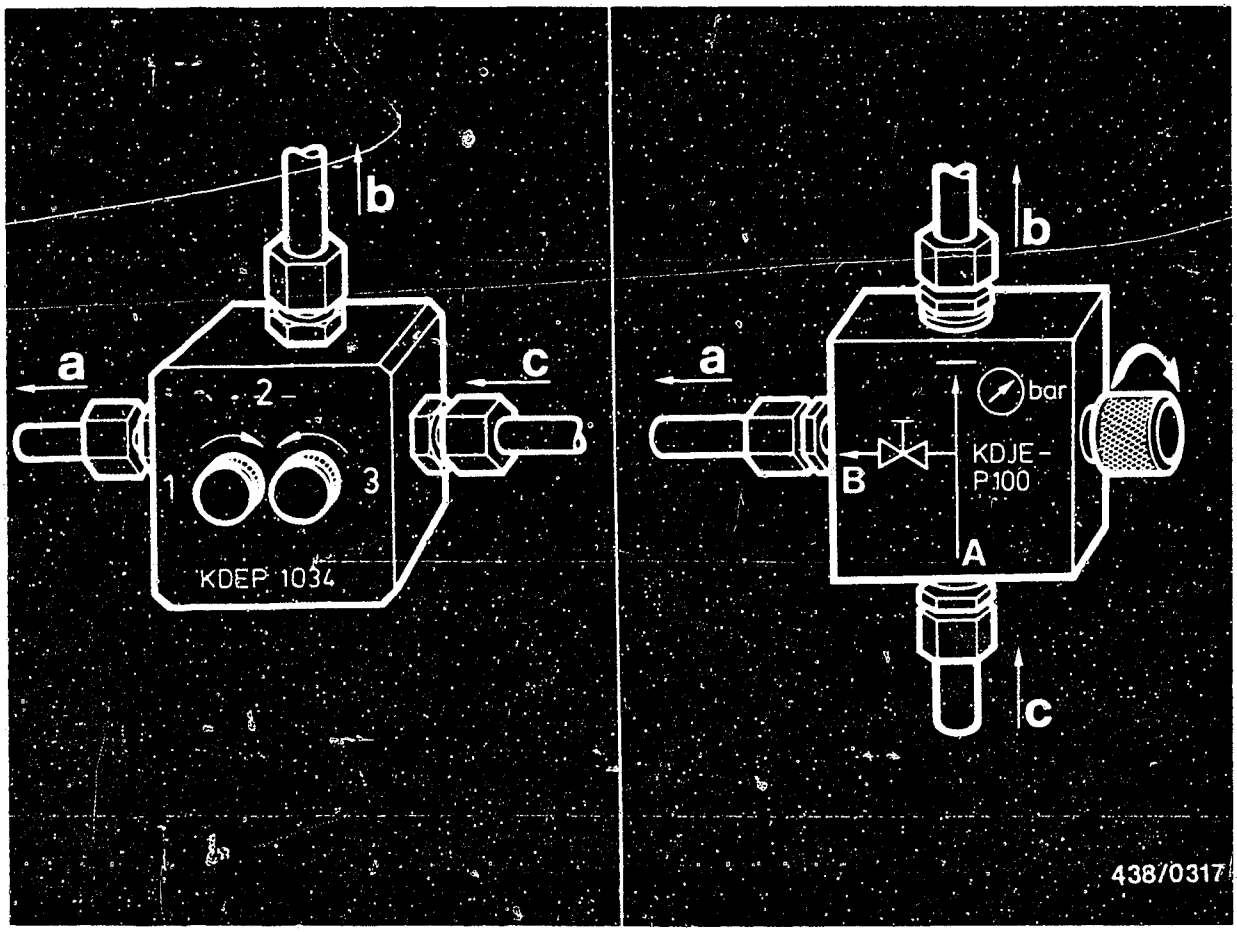
15.2 Bleeding the pressure tester

Disconnect the electric plug from the warm-up regulator. Let the pressure gauge hang down (hose fully extended).

Switch on the electrical fuel pump by bridging the electrical safety circuit.

Open and close the valve screw(s) of the directional-control valve in a 10-second rhythm about 5 times.

Then hang the pressure gauge from a suitable support (e.g. from one of the struts under the engine hood). Open valve screw of directional-control valve (both screws in the case of KDEP 1034) (turning to the left).



a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

15.3 Testing the primary pressure:

The test is performed with the engine switched off. The temperature of the engine is not important.

Close the valve screw of directional-control valve KDJE-P 100. In the case of KDEP 1034, close valve screw 1, open valve screw 3.

Switch on the electric fuel pump by bridging the electrical safety circuit.

The pressure gauge now indicates the primary pressure.

Fuel distributor Part No.	Test specifications - primary pressure (gauge pressure)
0 438 100 005	4.5...5.2 bar (4.6...5.3 kgf/cm^2)

Possible causes for too low a primary pressure:

- Fuel supply faulty.
 (Delivery of electric fuel pump too low).

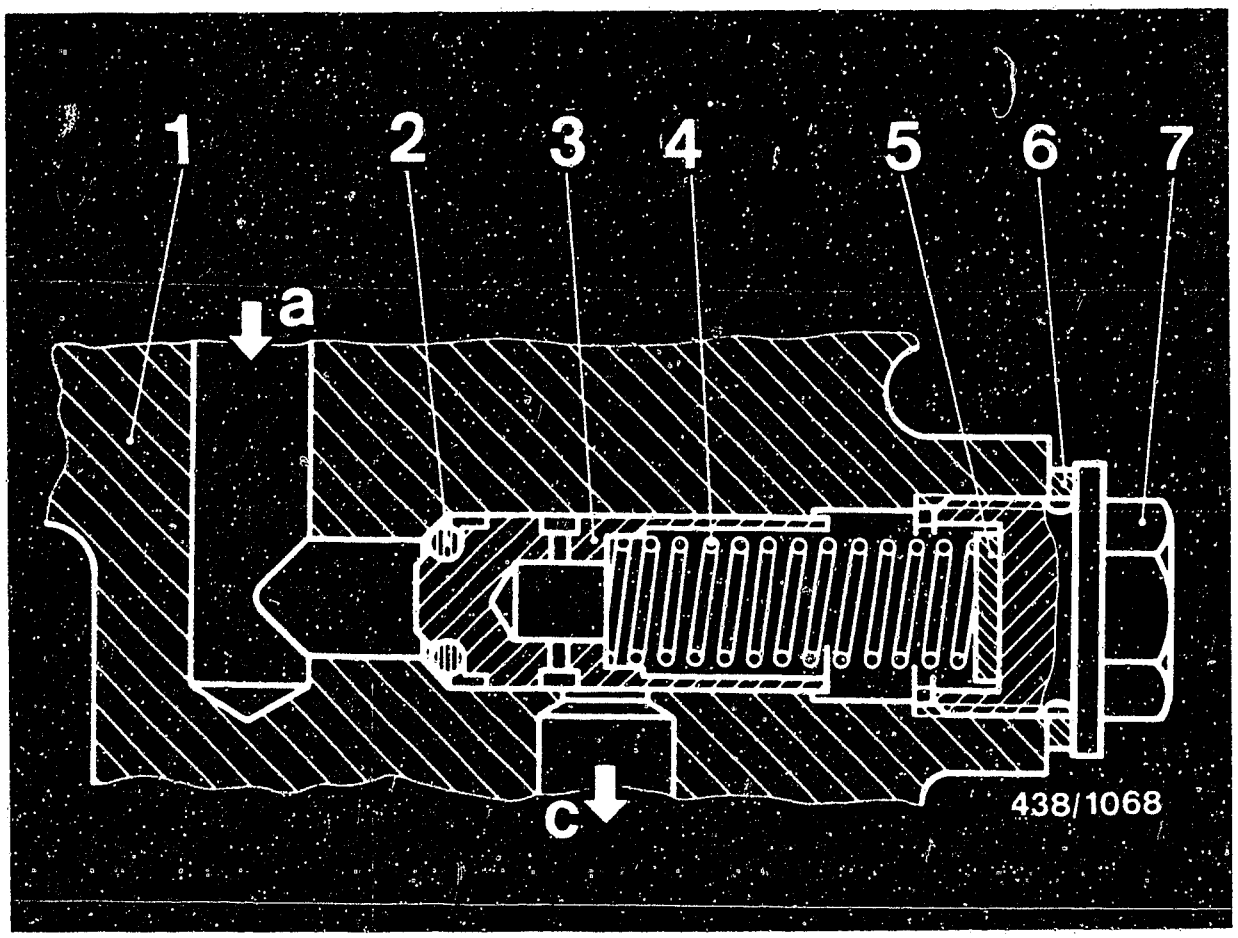
- Primary pressure set incorrectly.
 A precondition for readjustment of the primary pressure is always that the fuel supply is in order. Measure the fuel delivery. Test specification: 750 cm^3/30 s.

Possible causes for too high a primary pressure:

- A restriction in the return line leading to the fuel tank.

- Primary-pressure regulator set incorrectly.

For this reason, before readjusting too high a primary pressure, always first check the condition of the return line leading to the fuel tank.

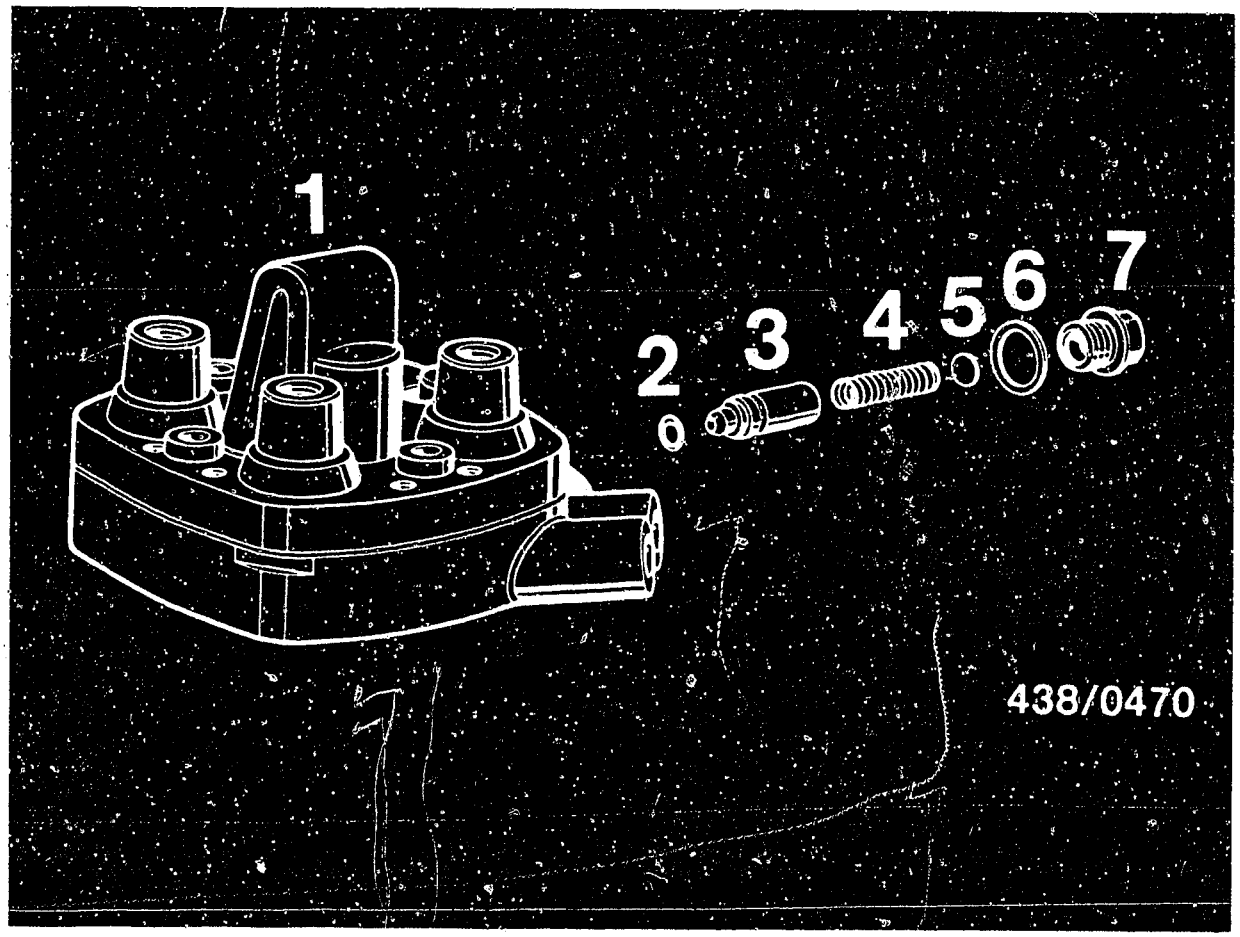


a = Primary pressure

c = Fuel return
1 = Fuel-distributor housing
2 = O-ring
3 = Control piston
4 = Control spring
5 = Shim(s)
6 = Flat seal ring
7 = Screw plug

15.4 Adjusting the primary pressure:

Fuel distributor Part No.	Adjustment values - primary pressure (gauge pressure)
0 438 100 005	4.7...4.9 bar (4.8...5.0 kgf/cm^2)

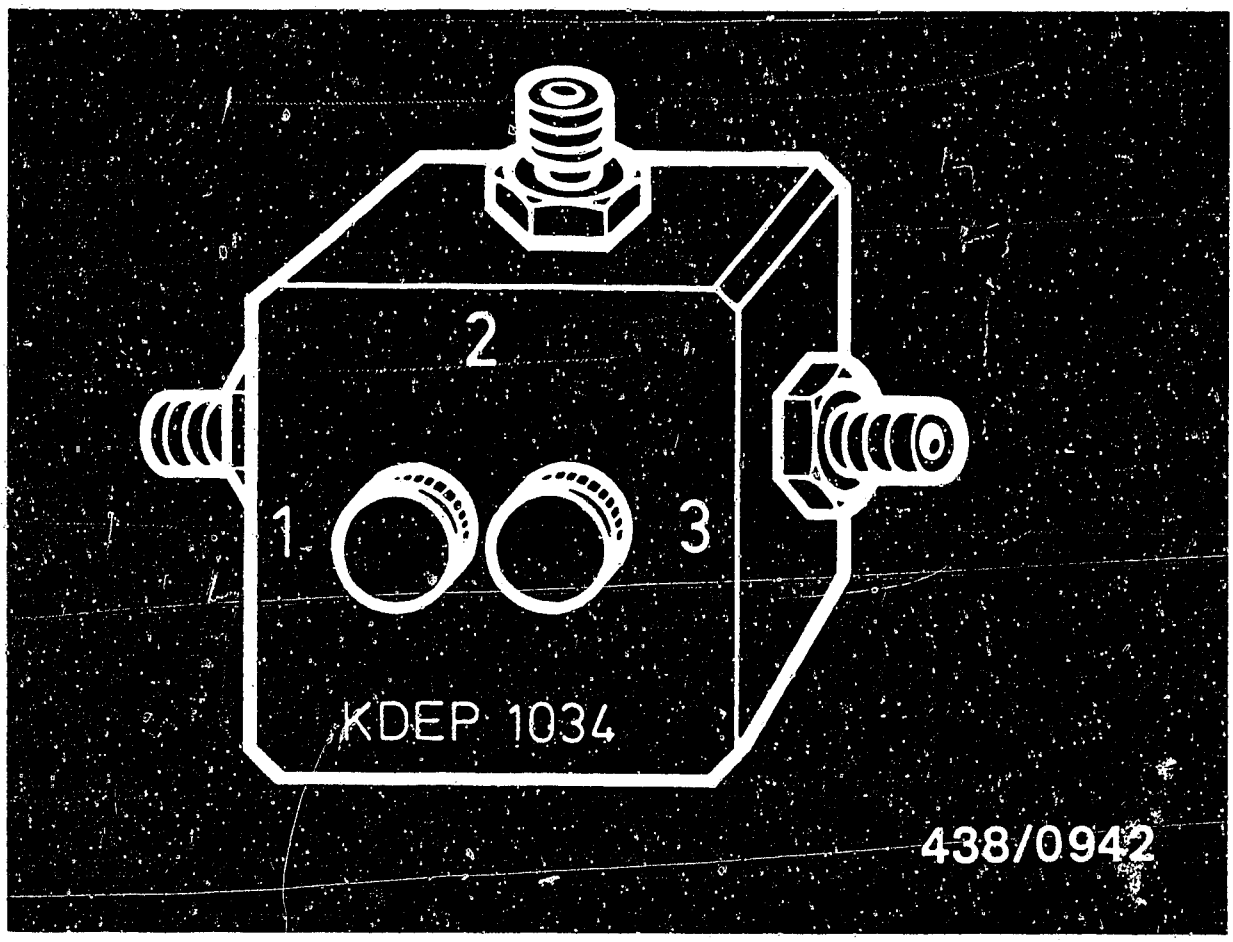


1 = Fuel distributor
2 = O-ring
3 = Control piston
4 = Control spring
5 = Shim(s)
6 = Flat seal ring
7 = Screw plug

Adjust the primary pressure by exchanging the shims Item 5.

Note: 0.1 mm more shim thickness means approx. 0.15 bar pressure increase and vice versa.

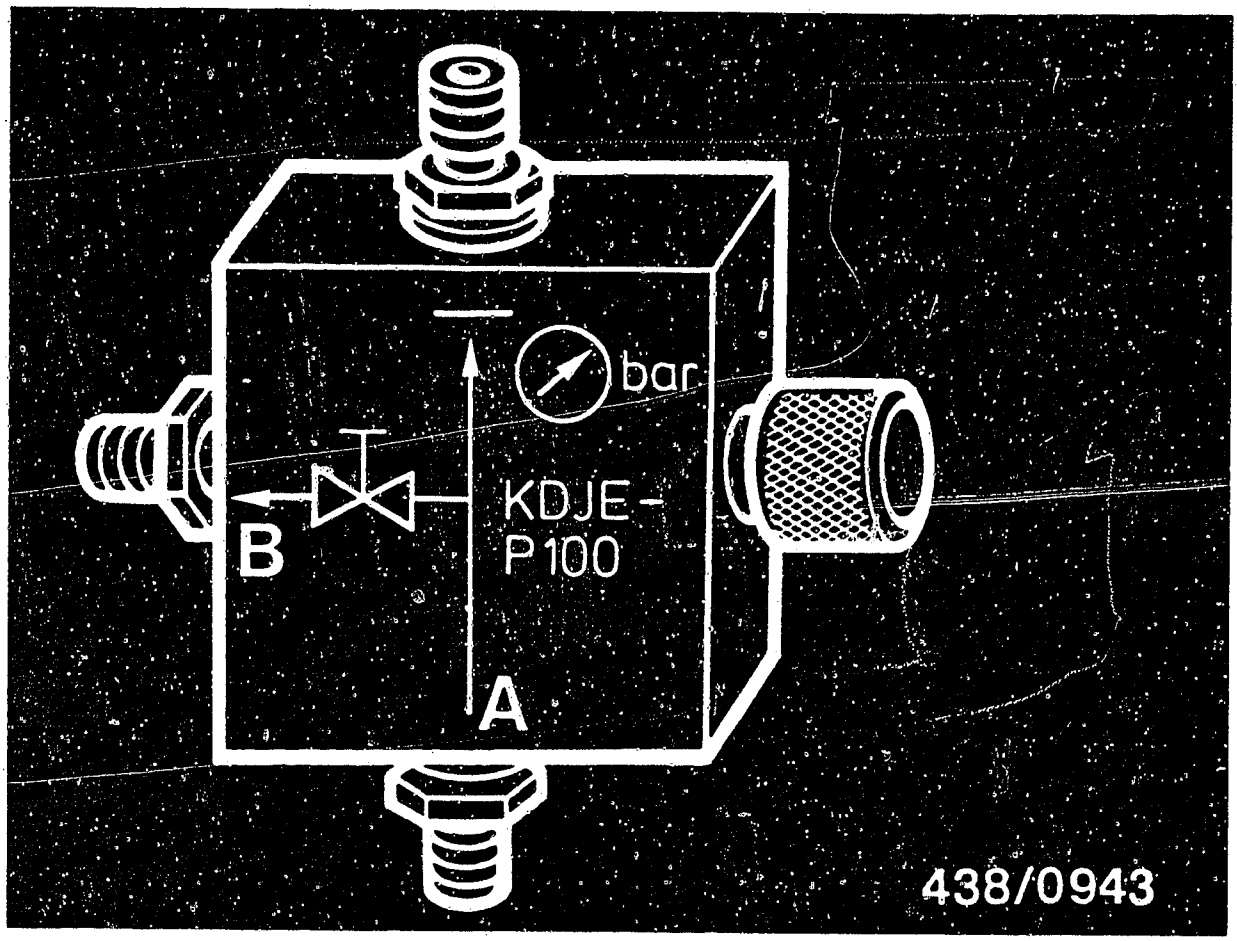
When mounting the screw plug, always use new seal ring - Item 6.
The control piston of the primary-pressure regulator must not be lost. It was matched at the factory to the fuel-distributor housing and is, therefore, the only part of the primary-pressure regulator which must not be replaced.



16. Testing the entire fuel system for leaks.

16.1 Mounting the pressure tester KDJE-P 100 (formerly KDEP 1034):

The pressure tester KDEP 1034 is equipped with a three-way valve with 2 separate valve screws. The connections of the directional-control valve are numbered (Fig. a).

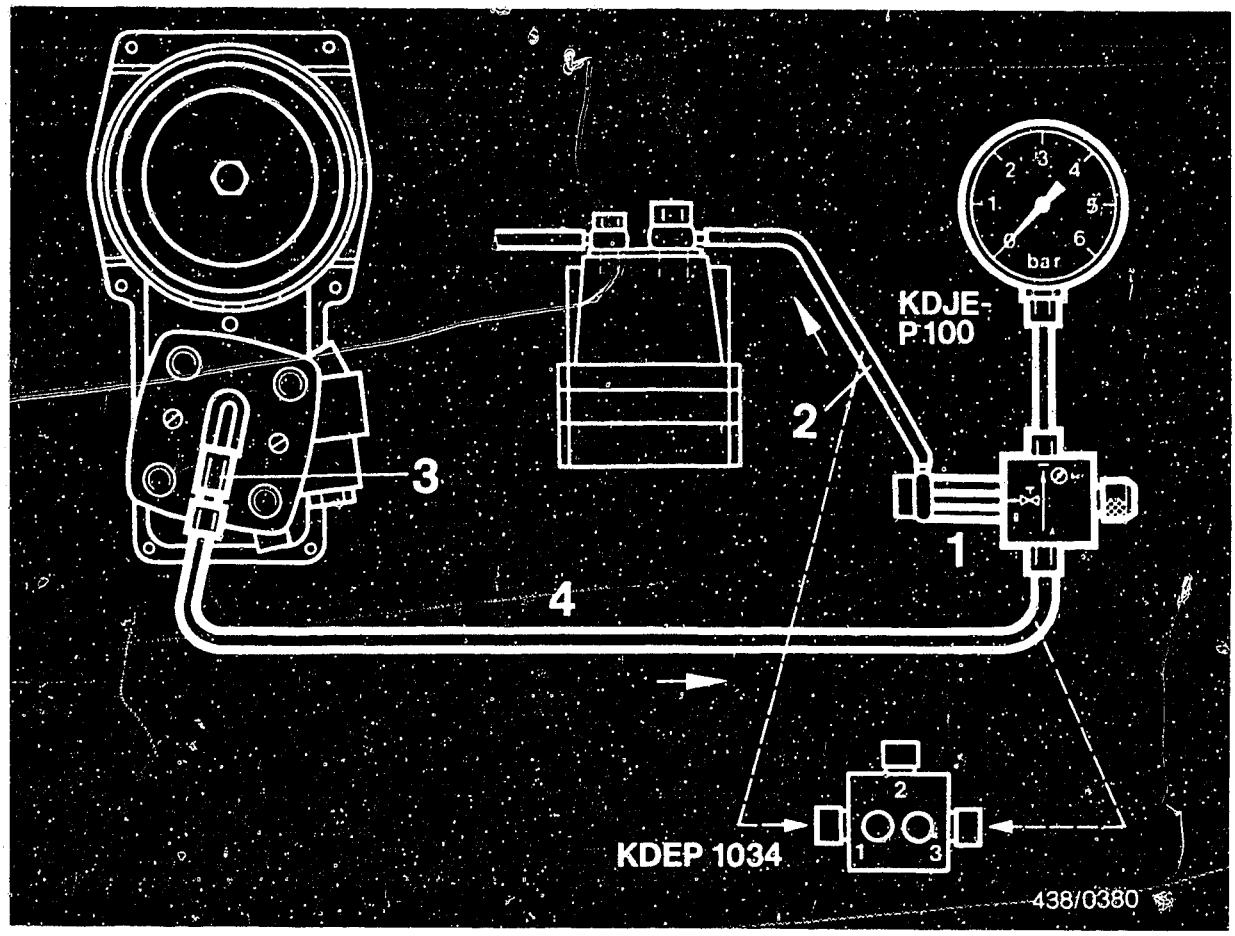


Since the end of 1979 the pressure tester KDJE-P 100 has been supplied. Its directional-control valve has only one valve screw (Fig. b). The connections of this directional-control valve are identified by symbols:

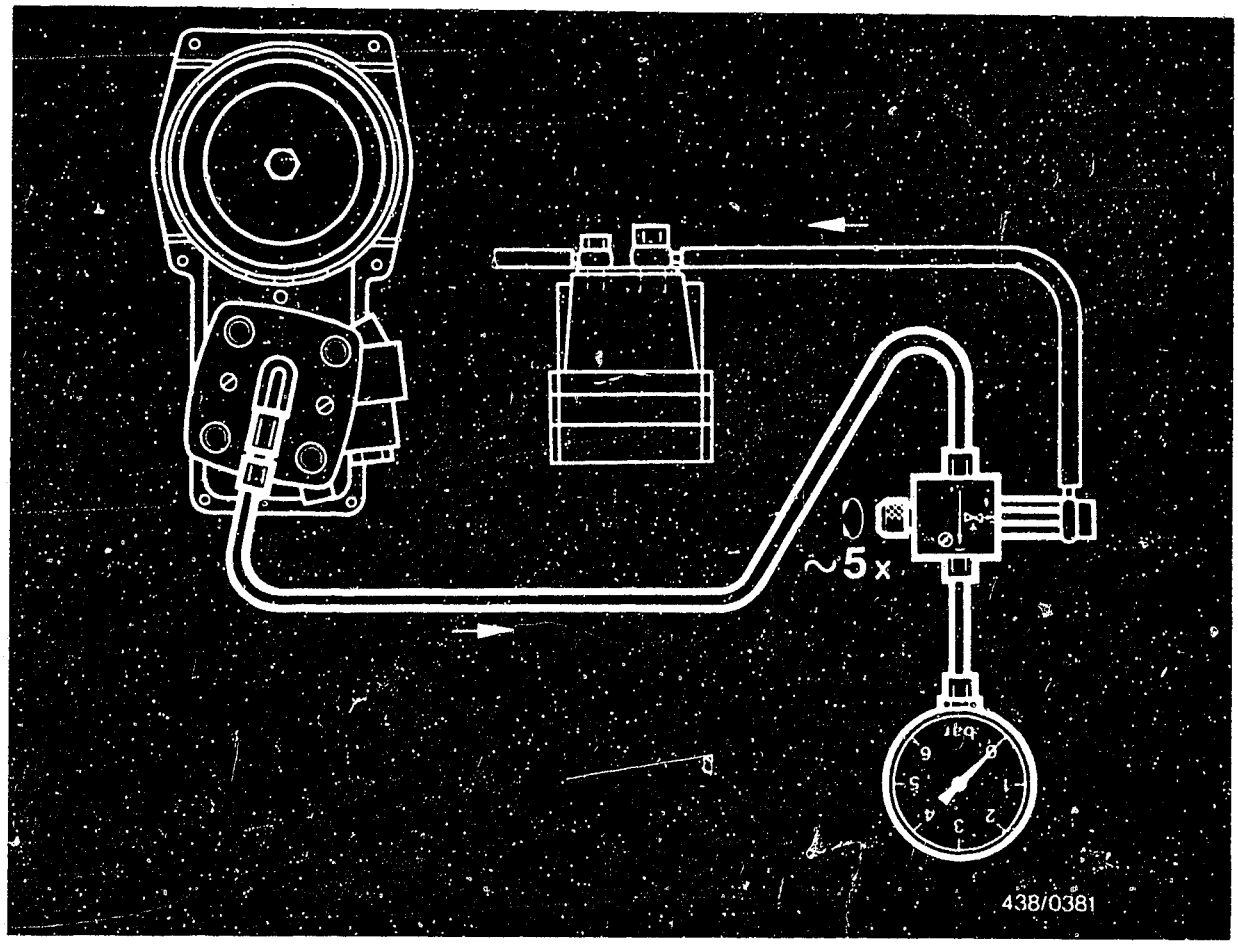
A = Inlet (from the fuel distributor)
B = Outlet (to the warm-up regulator)

Caution:

When the directional-control valve is not in use, always keep the valve screw(s) open in order to relieve the pressure on the seal rings.



The directional-control valve of the pressure tester is connected into the control-pressure line from the fuel distributor to the warm-up regulator.
Install using connecting-parts set KDJE-P 100/10 (previously KDEP 1034/10).
Screw the adapter (1) with seal ring onto the outlet fitting B or 1 of the directional-control valve.
Unscrew the control-pressure line (2) from the fuel distributor and connect to the adapter with inlet-union screw M 8x1 and seal rings.
Screw the connecting piece (3) of the connecting-parts set into the control-pressure connection port of the fuel distributor and connect to inlet fitting A or 3 of the directional-control valve via hose line (4).
Suspend the pressure gauge from the engine-compartment lid (possibly using a wire hook).

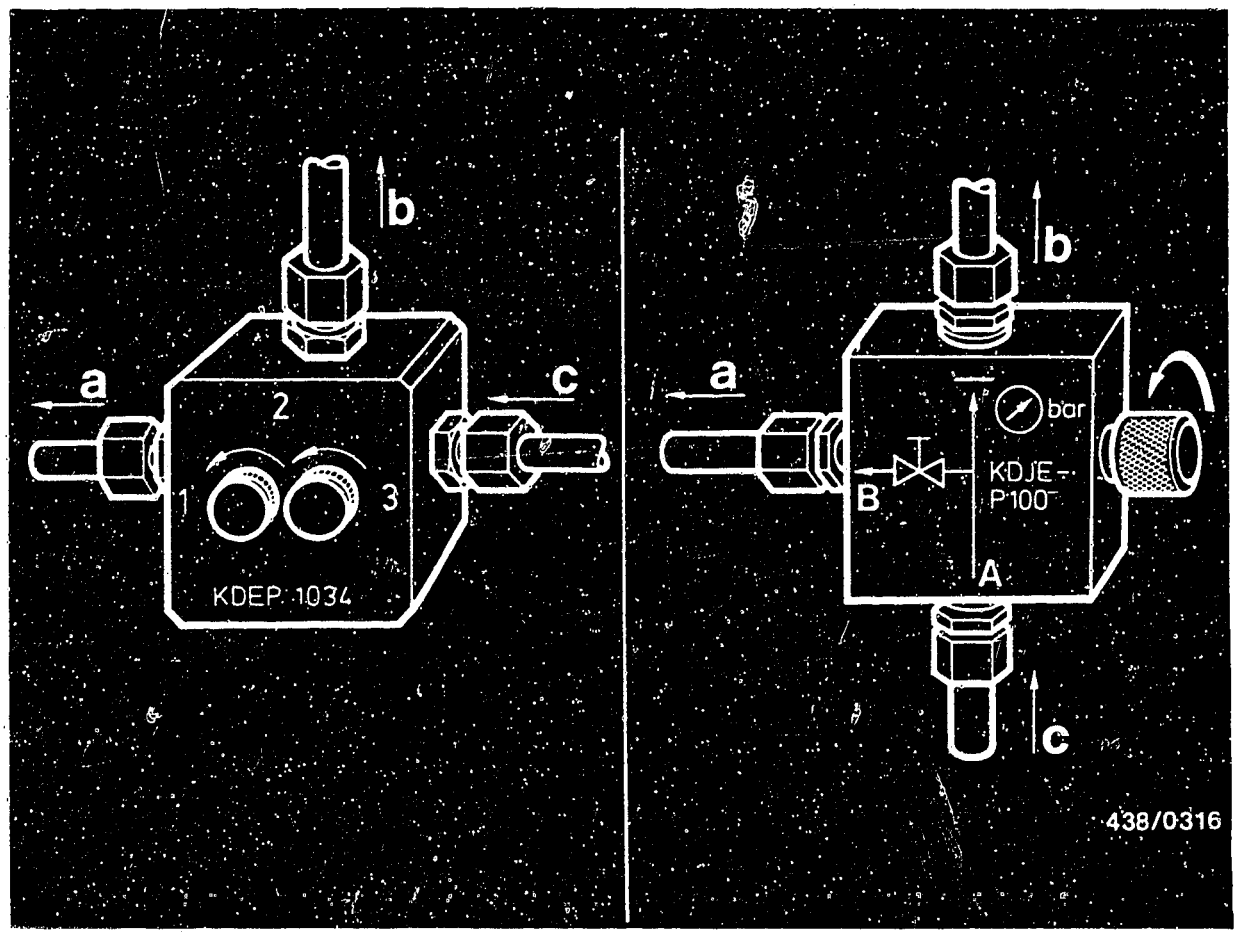


16.2 Bleeding the pressure tester

Disconnect the electric plug from the warm-up regulator. Let the pressure gauge hang down (hose fully extended). Switch on the electric fuel pump by bridging the electrical safety circuit.

Open and close the valve screw(s) of the directional-control valve in a 10-second rhythm about 5 times.

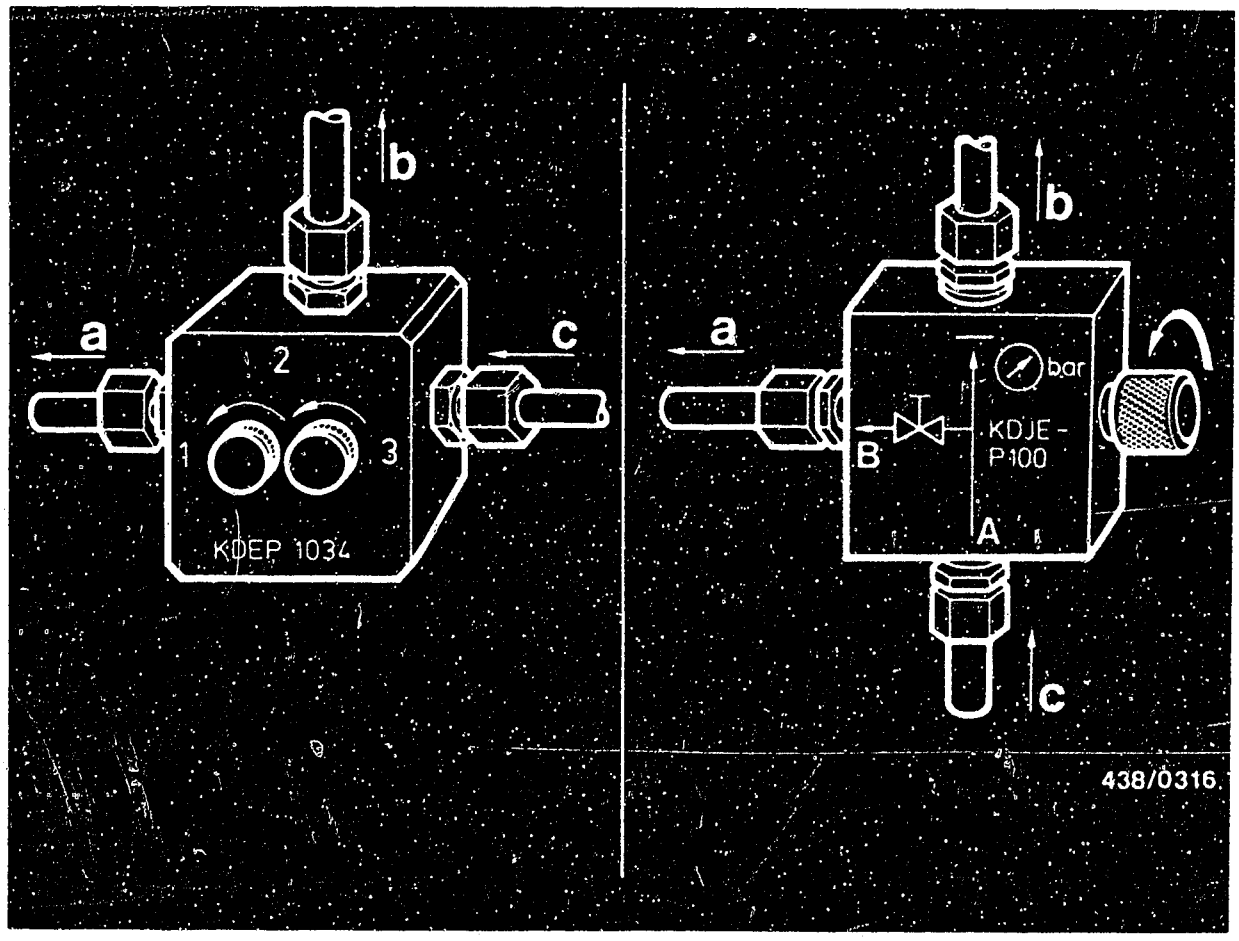
Then hang the pressure gauge from a suitable support (e.g. from one of the struts under the engine hood). Open valve screw of directional-control valve (both screws in the case of KDEP 1034)(turning to the left).



a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

16.3 Leak test

The test is performed with the engine switched off. Make the test with a warm engine but not immediately after the engine has been operated at a high temperature.
Open the valve screw of the directional-control valve (both valves in the case of KDEP 1034).

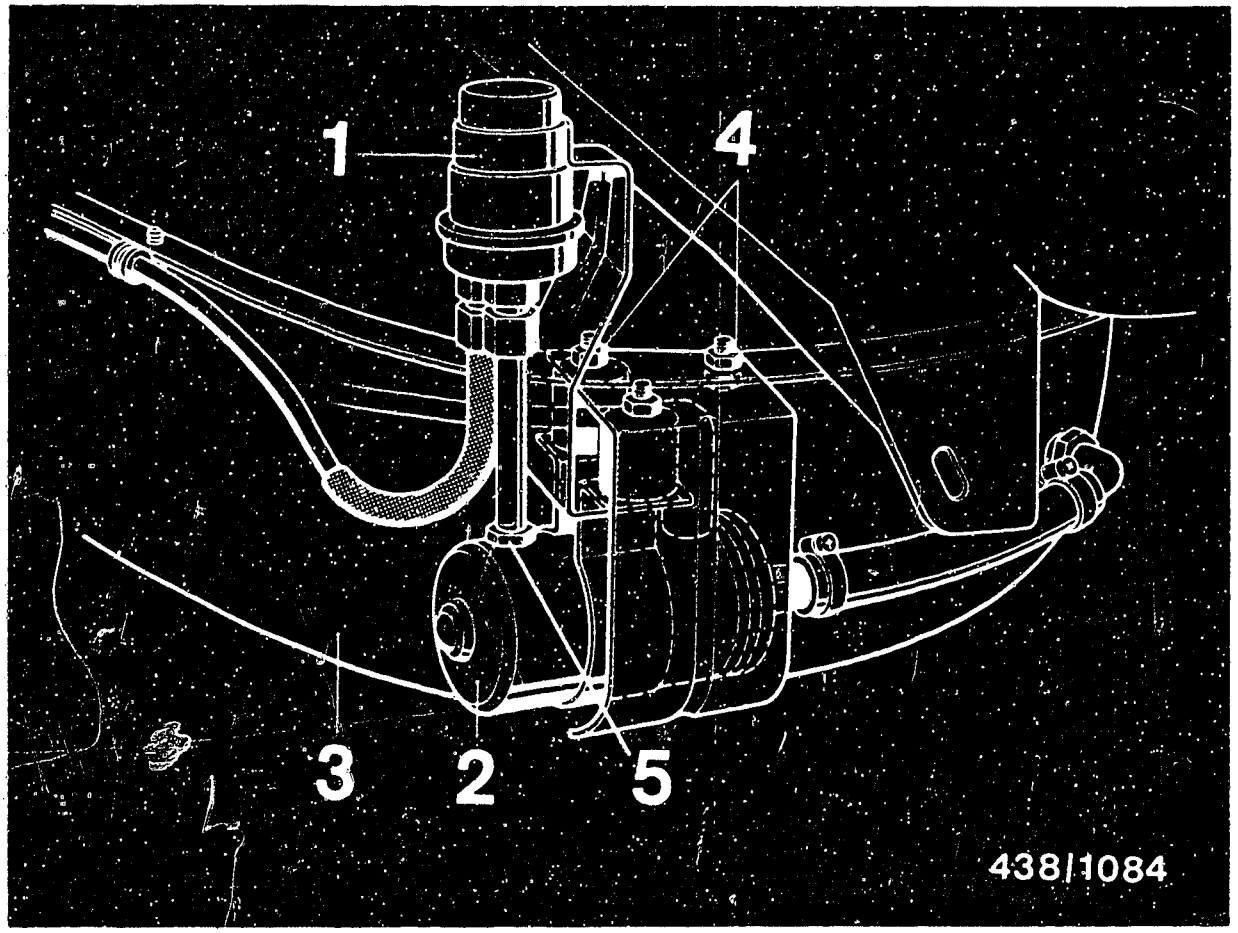


Switch on the electric fuel pump by bridging the electrical safety circuit until the warm-up regulator has ceased to operate ("warm" control pressure).

Switch the electric fuel pump off again and observe the drop in pressure on the pressure gauge.

Test specifications for leak test:

Minimum pressure (gauge pressure)
after 10 minutes: 2,0 bar (2,1 kgf/cm^2)
after 20 minutes: 1.7 bar (1.8 kgf/cm^2)



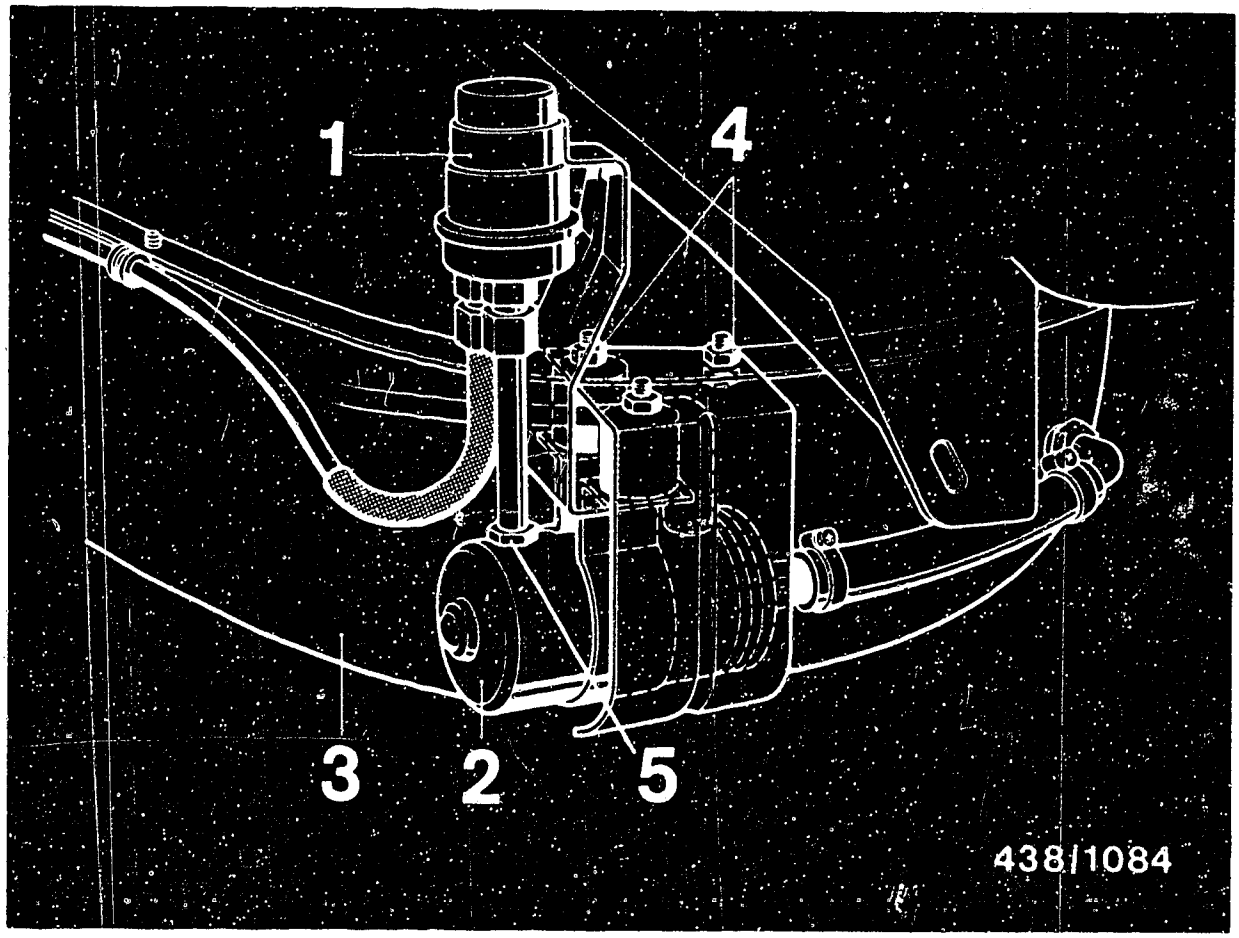
1 = Fuel accumulator
2 = Electric fuel pump
3 = Fuel tank
4 = Fastening nuts of bracket
5 = Delivery fitting with integrated non-return valve

16.4 Possible causes of trouble in the primary-pressure circuit

- Non-return valve in tube fitting of electric fuel pump leaking.

 Part number of electric fuel pump: 0 580 254 996
 Part number of non-return valve: 1 583 386 011
 Special seal ring: 1 580 203 001

The non-return valve is integrated in the tube fitting on the pump delivery side.
If leaking, replace tube fitting.



1 = Fuel accumulator
2 = Electric fuel pump
3 = Fuel tank
4 = Fastening nuts of bracket
5 = Delivery fitting with integrated non-return valve

To replace the non-return valve, remove the electric fuel pump.

To do this, pinch off the intake hose before loosening (e.g. using hose clamper W 157 from Matra Co.) and remove complete bracket for electric fuel pump and fuel accumulator.

Unscrew delivery line from fuel accumulator and remove electric fuel pump from bracket.

Note:
Changing the electric fuel pump requires a new delivery line to the fuel accumulator.
This calls for a new 45 mm long piece of polyamide line, 8 mm inside diameter, for pressures of at least 25 bar.

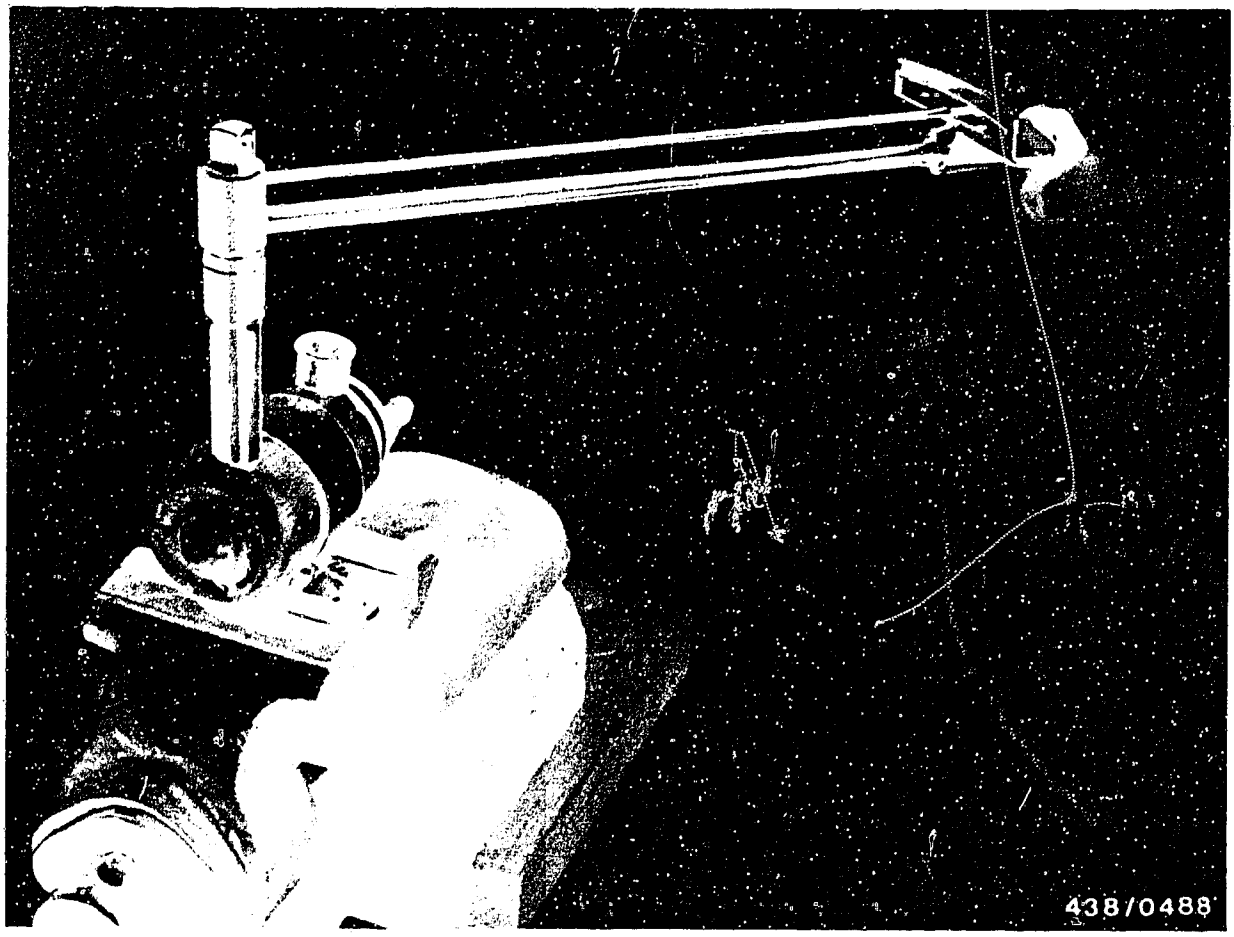
Cut open the old line in the region of the delivery fitting (non-return valve) and of the screw nipple using a soldering iron and pull off.

C A U T I O N !

Do not use an open flame for heating the line.

Danger of fire !

It is also not advisable to cut open the line using a knife because this will damage the toothed section of the fittings.



Clamp the pump in a vice by the clamping band (never clamp by pump housing).
Unscrew fitting.

Caution: No dirt or chips must get into the inside of the pump.

Always screw in a new tube fitting with a new seal ring. Tightening torque 16...20 Nm (1.6...2.0 kgfm).

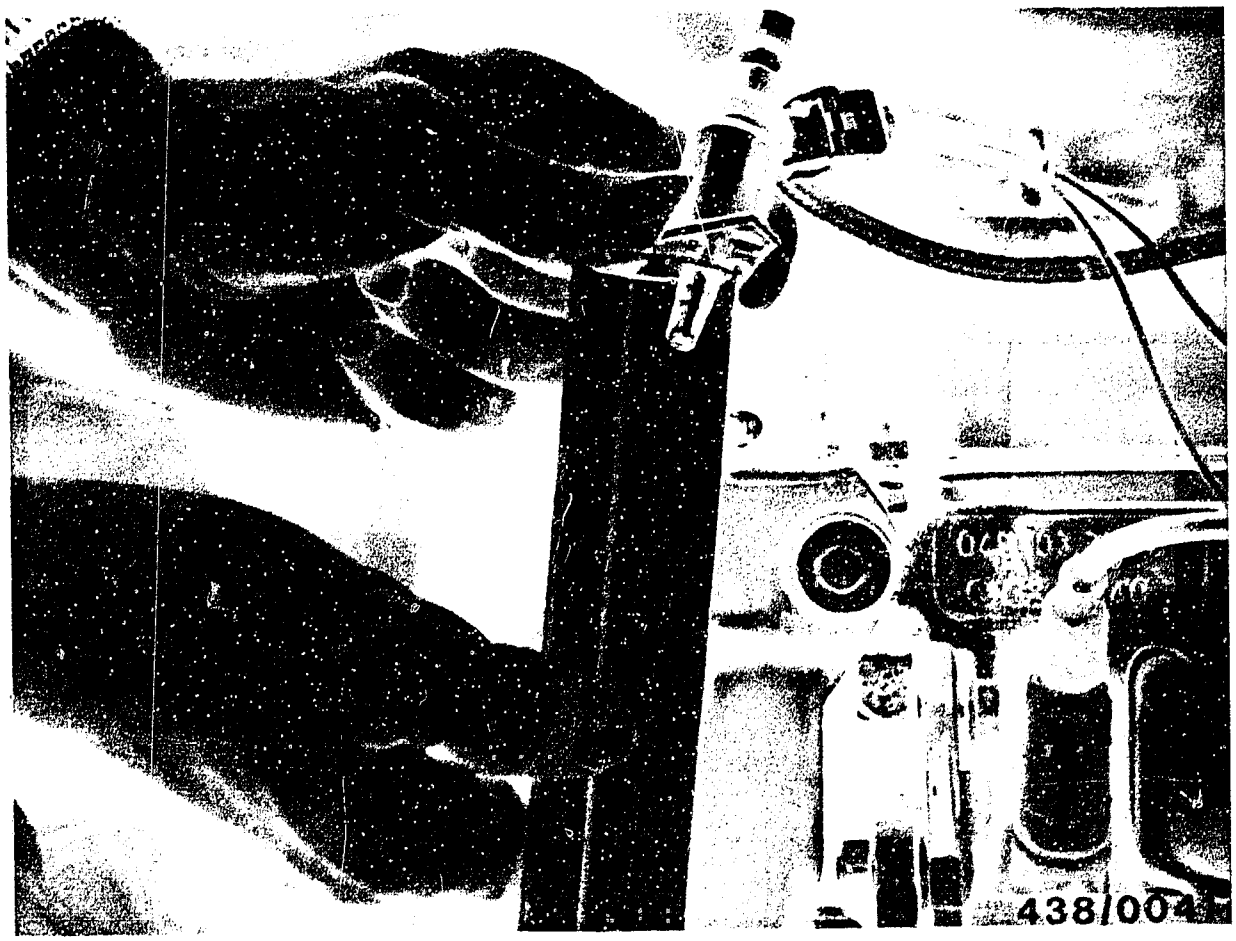
Caution: Use only the specified seal ring, since it is of special dimensions. Always observe the specified tightening torque and do not exceed, otherwise there is the danger of warping the housing and damaging the thread.

Insert new hose line into assembly tool KDEP 1039 so that it projects by the amount of the length of the nipple.
Clamp the assembly tool in a vice and knock the screw nipple cold into the line using a clean plastic mallet.

Clamp the other end of the delivery line in the same manner in the assembly tool and press cold onto the delivery fitting of the electric fuel pump.
Hold the electric fuel pump when doing this - do not clamp in vice.

Important:
Do not heat the line for pressing on since it will undergo permanent expansion, which will lead subsequently to leaks.

Reinstall the electric fuel pump.
Remove the hose clamper from the intake line and, finally, check all connections for leaks with the electric fuel pump operating.



Further possible cause of leaks in the primary-pressure circuit:

- Start valve leaking.

Remove the plug from the start valve and remove the start valve. The fuel line remains connected.

Hold the start valve in a suitable vessel (e.g. a graduate).

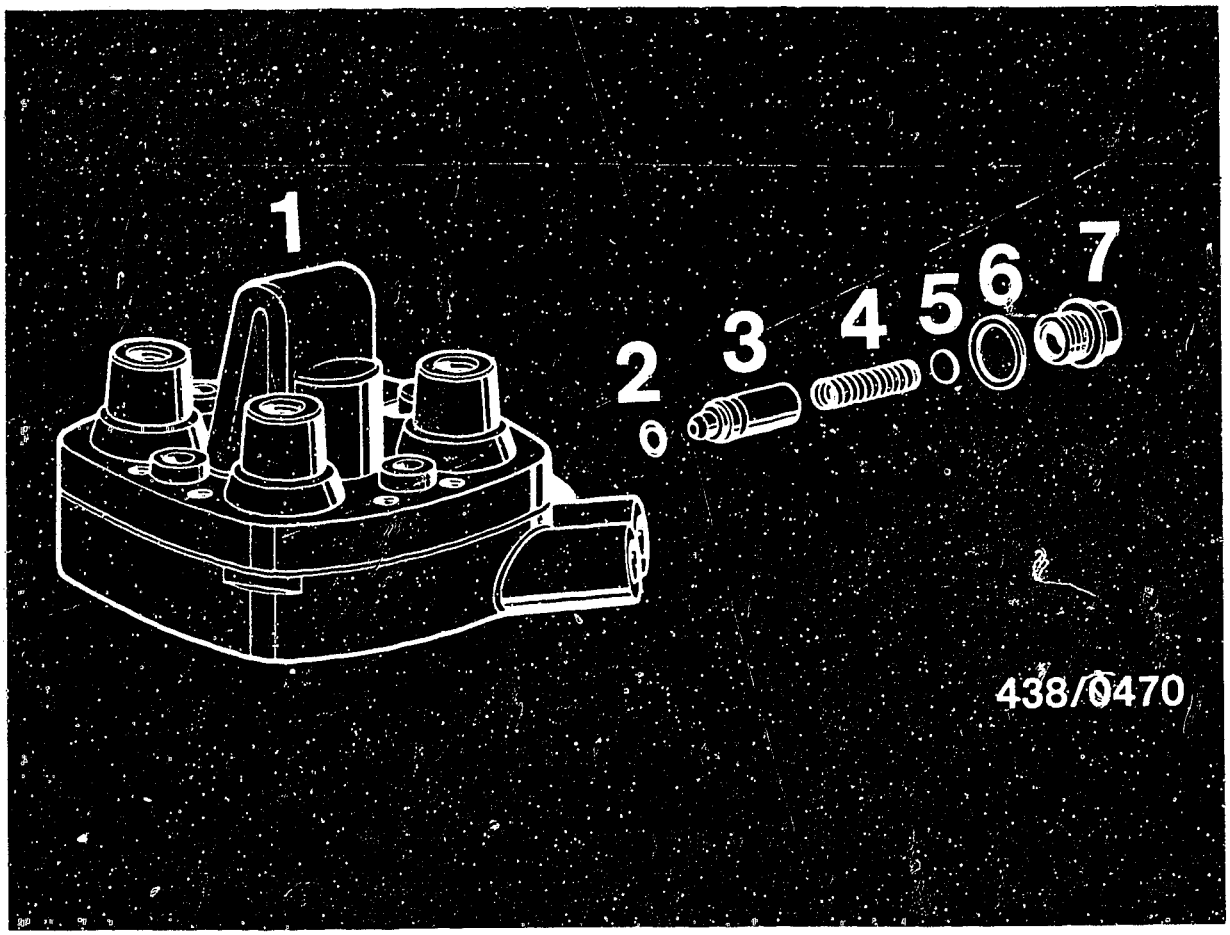
Switch on the electric fuel pump by bridging the electrical safety circuit so that primary pressure is applied to the start valve.

Dry off the nozzle of the cold-start valve.

No drops must fall from the nozzle of the start valve within the next minute. Even when shaken and knocked, the start valve must not leak.

Switch the electric fuel pump off again.

Replace the cold-start valve if leaky.
Finally, adjust idle speed with the engine at operating temperature.
Idle-speed adjustment is described on Coordinates F 1 .



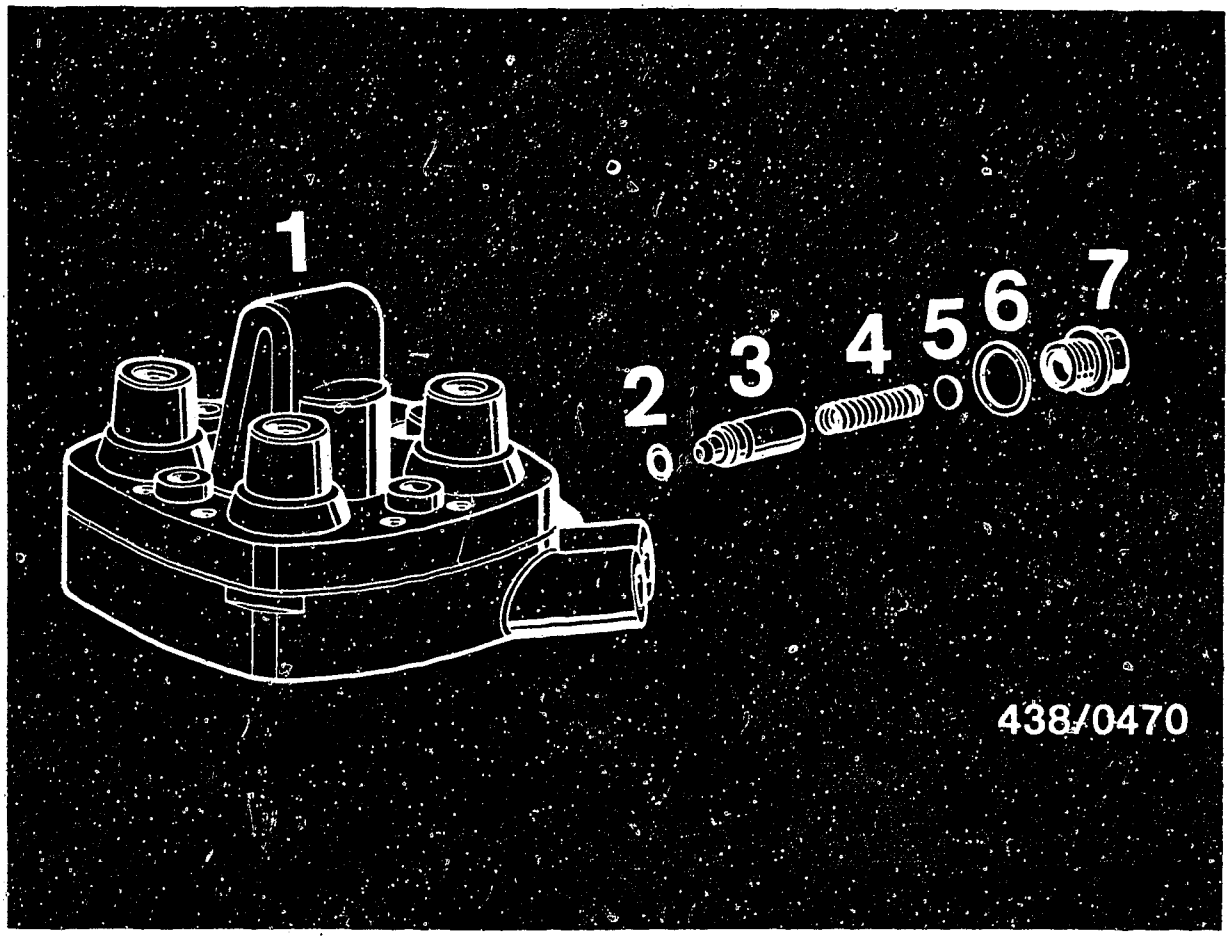
1 = Fuel distributor
2 = O-ring
3 = Control piston
4 = Control spring
5 = Shim(s)
6 = Flat seal ring
7 = Screw plug

Further possible cause of a leak in the primary-pressure circuit:

- Control-piston seal ring (O-ring) of the primary-pressure regulator has a leak.

Replace seal ring:
Clean fuel distributor in the region of the primary-pressure regulator.

Screw out screw plug (pay attention to shims), remove control spring and control piston.
Replace seal ring (O-ring) (2) on control piston; install control piston and control spring.



1 = Fuel distributor
2 = O-ring
3 = Control piston
4 = Control spring
5 = Shim(s)
6 = Flat seal ring
7 = Screw plug

Screw in screw plug (7) with shims (5), as found when removing, and with new flat seal ring (6).
Finally, check the primary pressure and, if necessary, adjust by changing the shims (5).

Primary pressure:

Fuel distributor	0 438 100 005
Checking value:	4.5...5.2 bar (4.6...5.3 kgf/cm²) gauge pressure
Setting value:	4.7...4.9 bar (4.8...5.0 kgf/cm²) gauge pressure

16.5 Possible cause of trouble in control-pressure circuit

The fuel distributor 0 438 100 005 is a version without push valve.
The return of the warm-up regulator leads directly to the collective return line to the fuel tank.
Therefore, the only possible cause of a leak in the control-pressure circuit is the warm-up regulator.
Therefore, replace the warm-up regulator.

When the warm-up regulator has been replaced or another fault remedied, finally perform the idle adjustment with the engine at normal operating temperature.

Idle adjustment is described as of Coordinate F 1.



17. Testing the injection valves.

Remove the injection valves for testing. They are inserted into appropriate bores in the cylinder head and are located by holding plates (arrow).

Unscrew the fuel lines. Screw out the fastening screws. Lift off the holding plates and remove the valves from the bores.

When re-installing the injection valves, the O-rings on the valve stems should if possible be replaced (Volvo service part) in order to prevent leaks and thus the entry of unmetered air.

17.1 Test equipment and test media

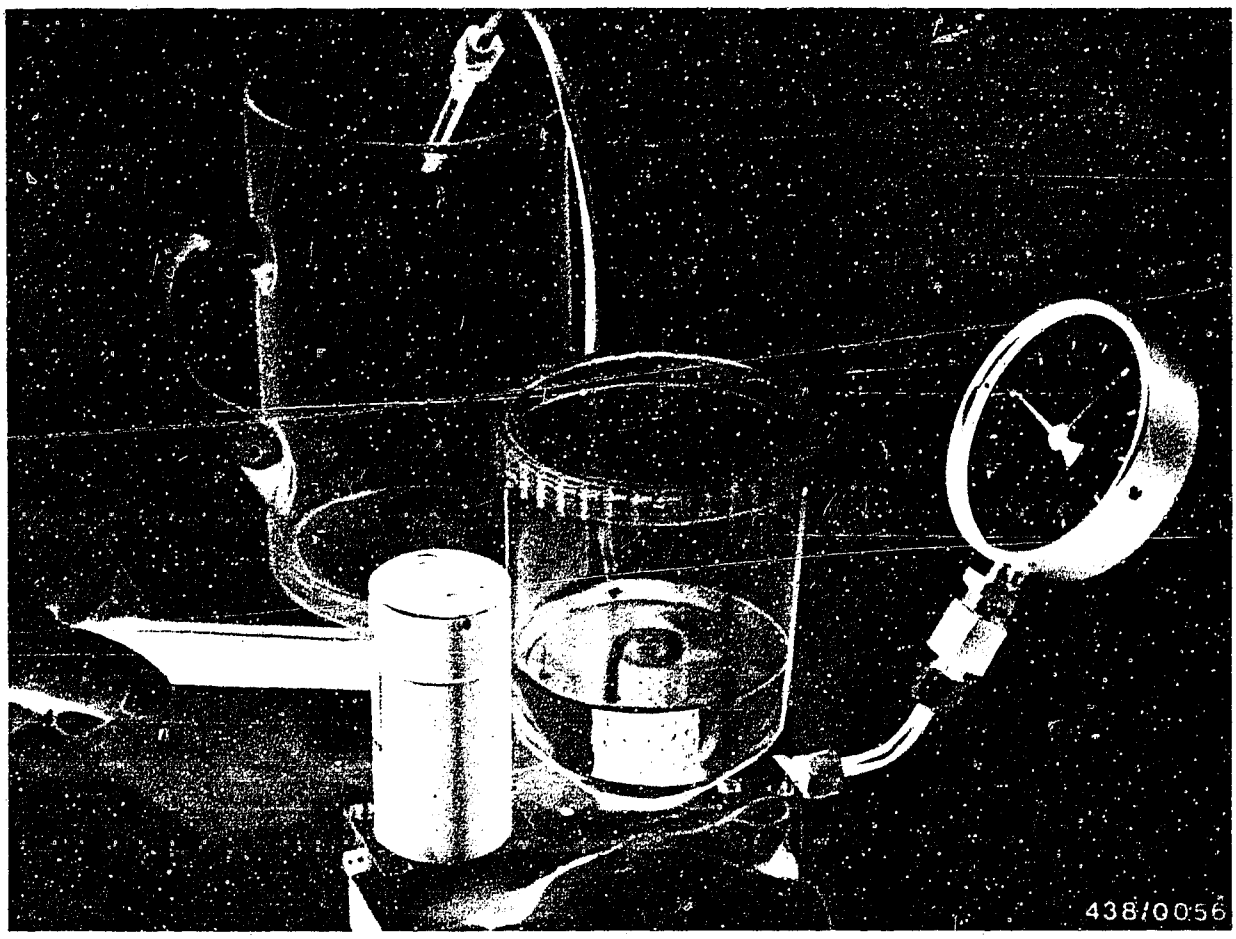
The following testing specification refers to valve testers KDJE-P 400 (previously KDEP 7452) and 0 681 200 700.

Observe the test-media specification!

Test media: Calibrating fluid (Shell K 30, Esso-Varsol, Shell Mineral Spirits 135)
or
Bosch, Part No. VS 14 942-CH
Former Part No. 5 973 340 650
The calibrating fluid can be obtained in 5 l metal cans from the following supplier:

Firma
Oskar Gnamm GmbH
D-7531 Kämfelbach-Bilfingen

Caution:
For safety reasons, never use normal gasoline or similar easily inflammable and combustible liquids.
Even with calibrating fluid, be sure to observe the local official regulations.

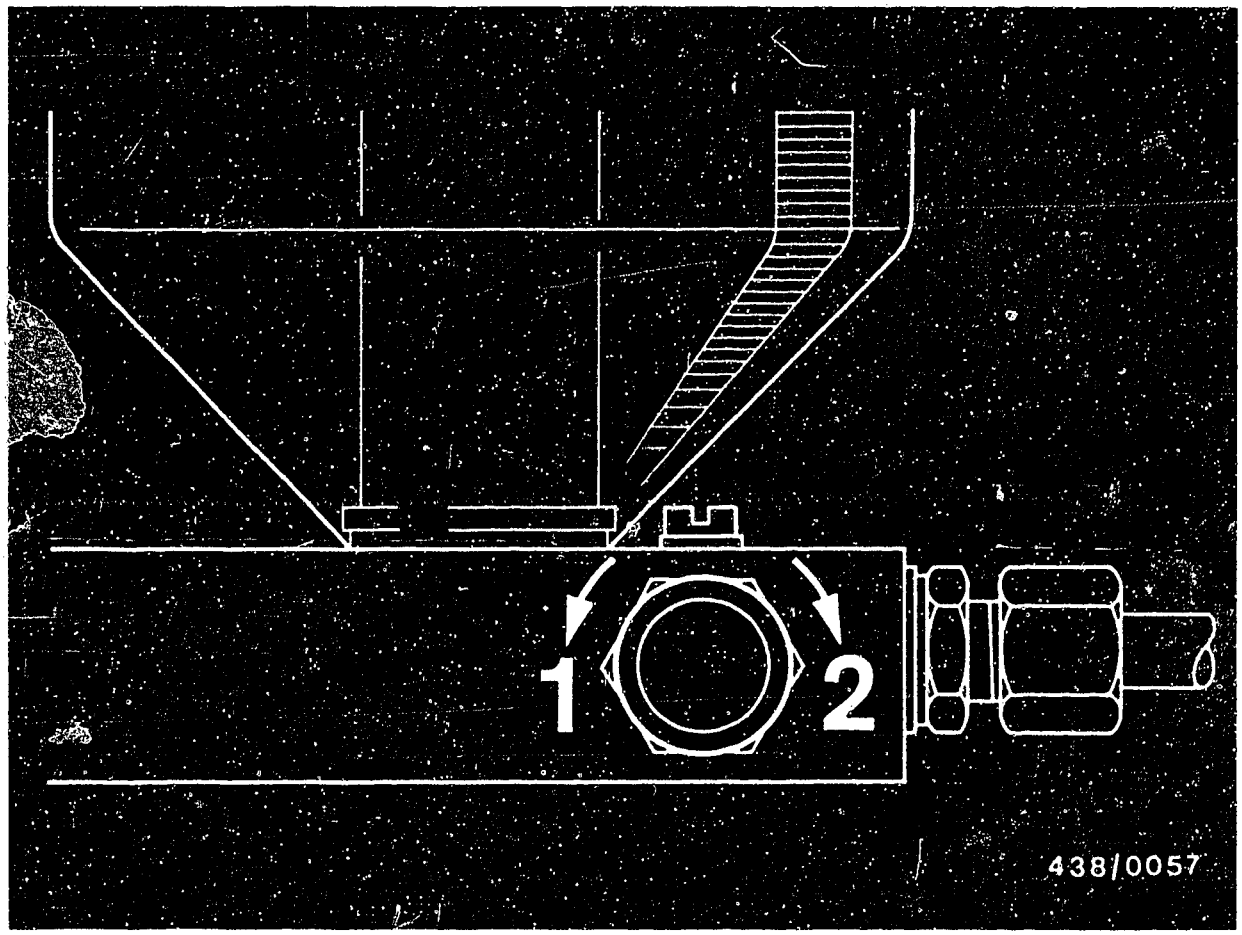


17.2 Connecting the injection valve to the tester

Connect the injection valve to the valve tester and bleed the delivery line by operating the lever several times with the union nut open. Then tighten the union nut.

17.3 Checking for dirt

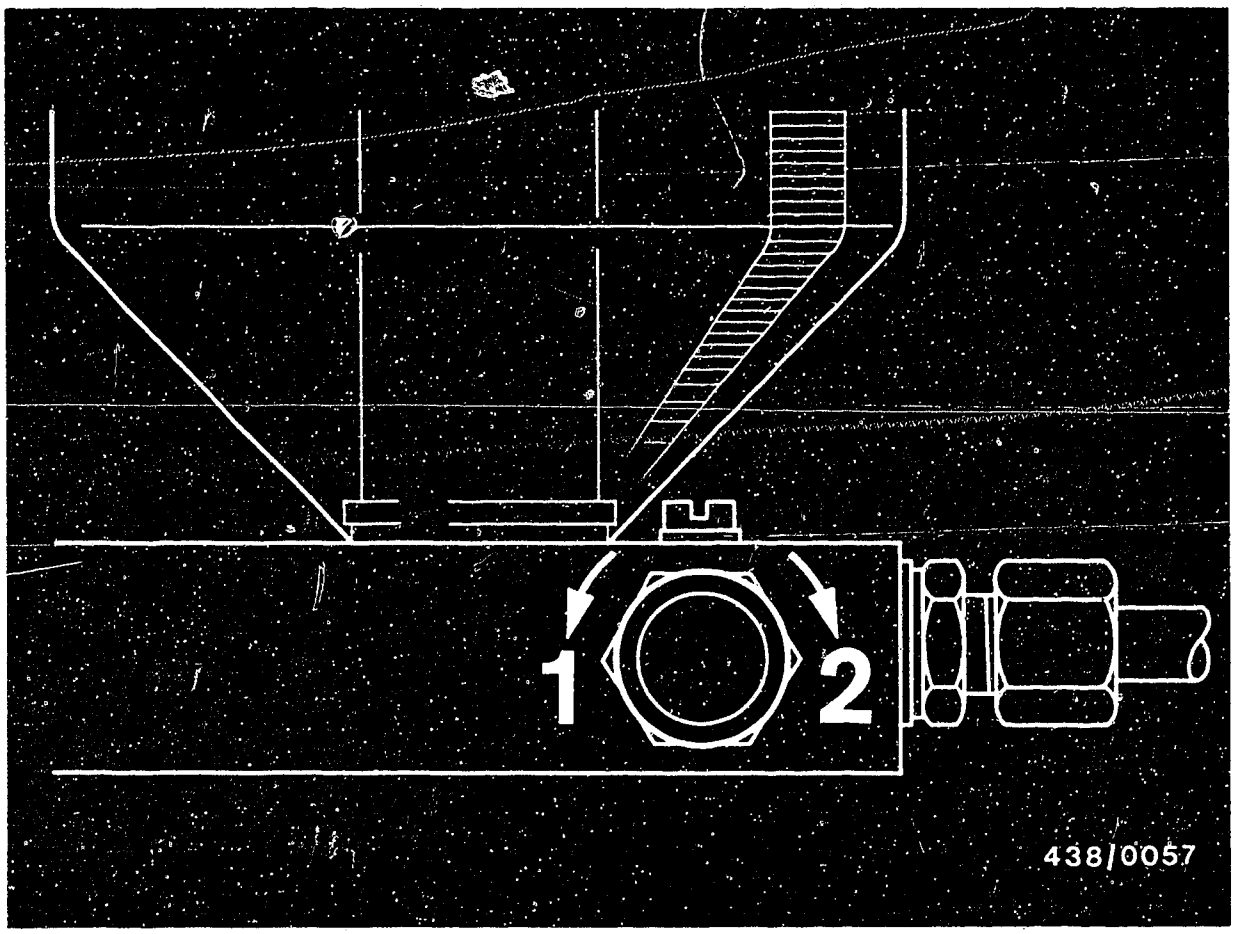
Move the hand lever slowly (about 2 seconds per stroke) back and forth with the stopcock on the pressure gauge open. If the pressure does not build up to 1...1.5 bar gauge pressure, the injection valve has a bad leak (caused, for example, by dirt stuck in it).
You can try to flush the injection valve clear by moving the lever back and forth several times strongly.
If this attempt is successful, continue the test. If it is not possible to flush the valve clear, replace it.



1 = Open 2 = Closed

17.4 Testing the opening pressure

Injection valve Part number	Test specifications - Opening pressure Gauge pressure
0 437 502 007	2.5...3.6 bar (2.6...3.7 kgf/cm²)



With the stopcock closed, flush the valve out and bleed it with several rapid movements of the lever.
Open the stopcock and test the opening pressure by moving the lever slowly (about 2 seconds per stroke).

If the opening pressure is outside tolerance, replace the injection valve. Individual valves can also be interchanged within a set.

17.5 Leakage test

Open the stopcock, build the pressure up slowly to a value 0.5 bar under the opening pressure determined previously (but not less than 2.3 bar gauge pressure), and hold it constant at that level. No drops must now fall from the valve for the next 15 seconds.

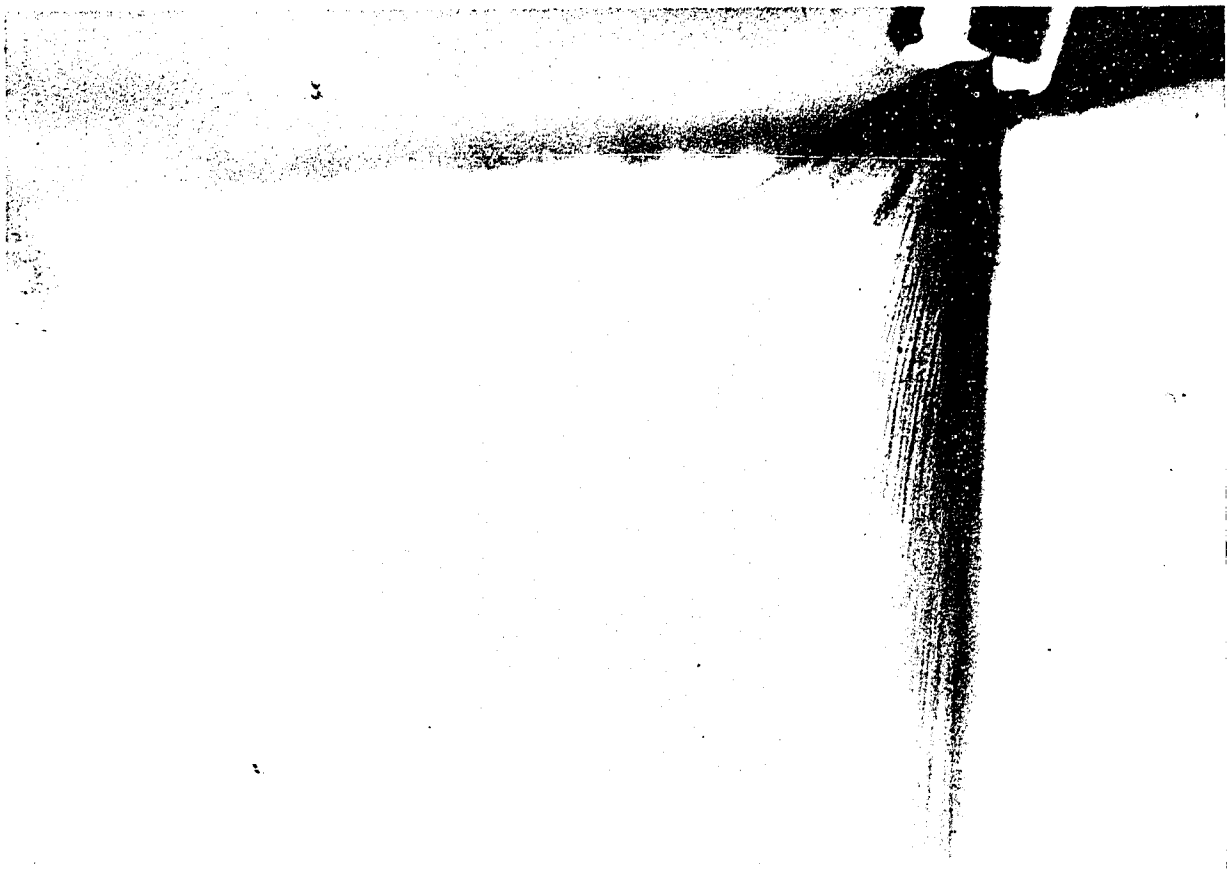


438/0058

17.6 Chatter test, evaluation of spray

Move the lever back and forth at about 1 stroke per second. As this is done, the valve must chatter. No drops of fuel must form at the mouth of the valve. The valve must not produce a "cord spray". Formation of a single-sided, atomized spray within an overall spray angle of about 35° is permissible (see example given in illustrations).

Illustration shows good spray formation.



438/0059

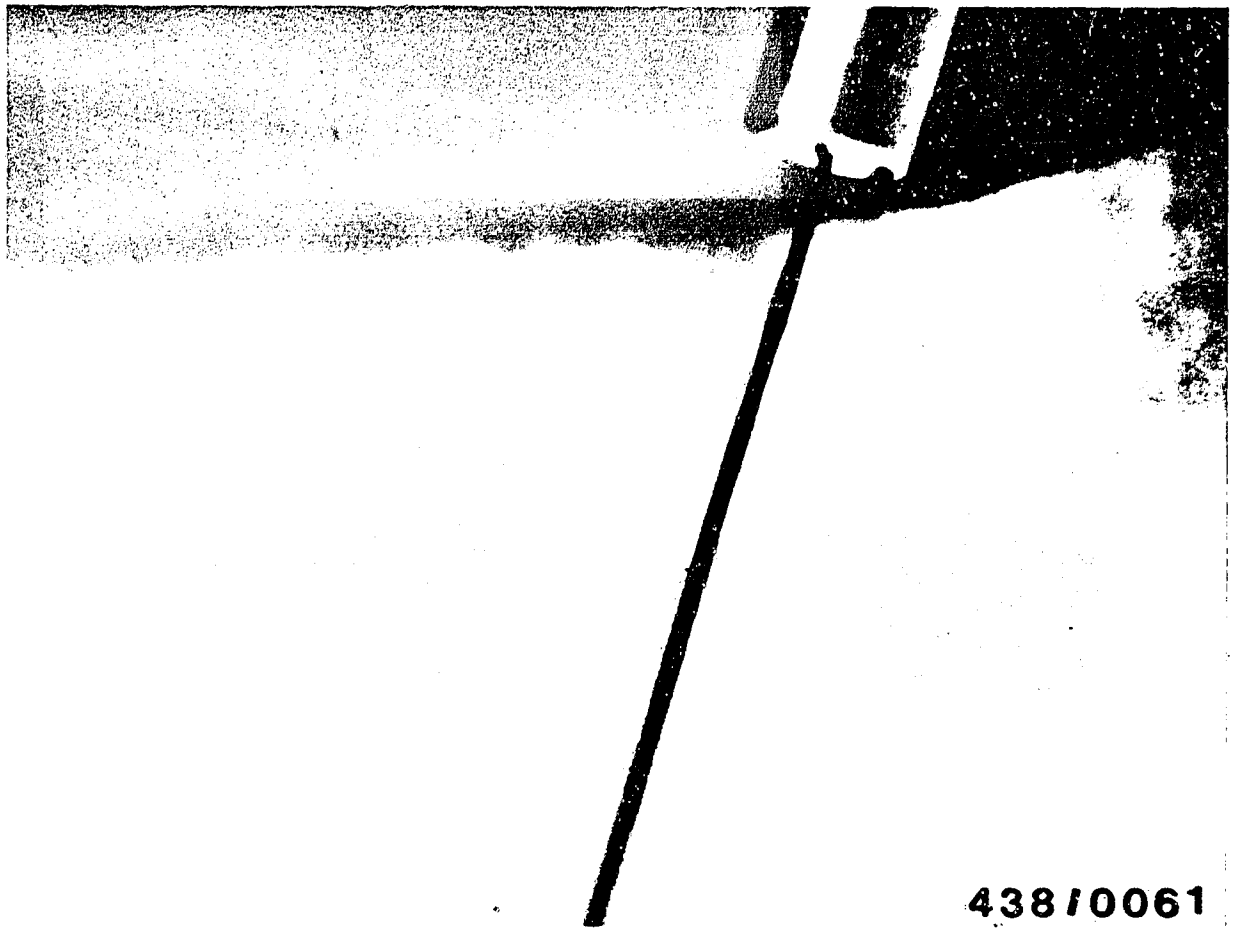
Illustration shows single-sided but nevertheless good spray formation.



438/0060

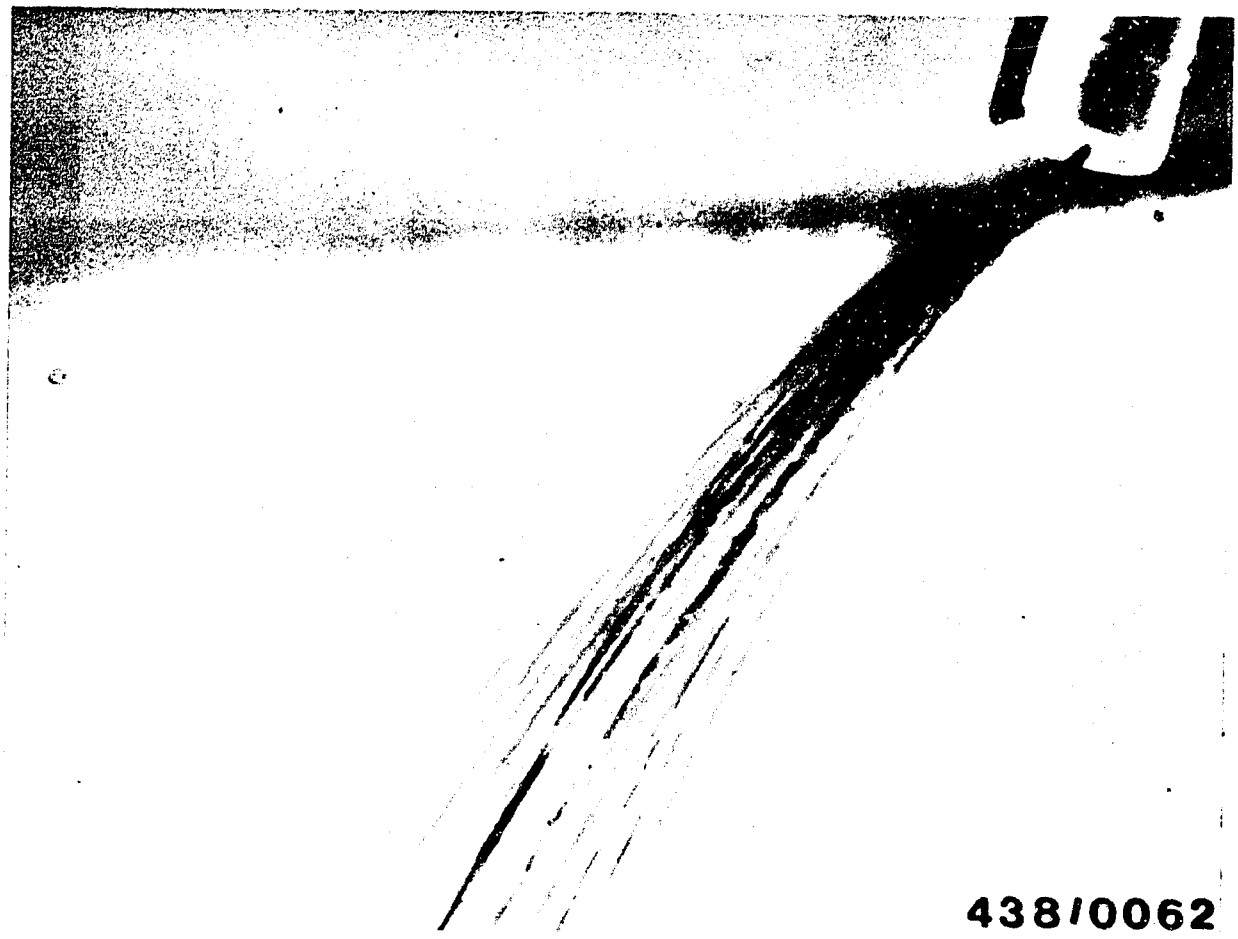
Poor spray formation; replace injection valves.

Illustration shows drop formation.



Poor spray formation; replace injection valves.

Illustration shows "cord" spray.



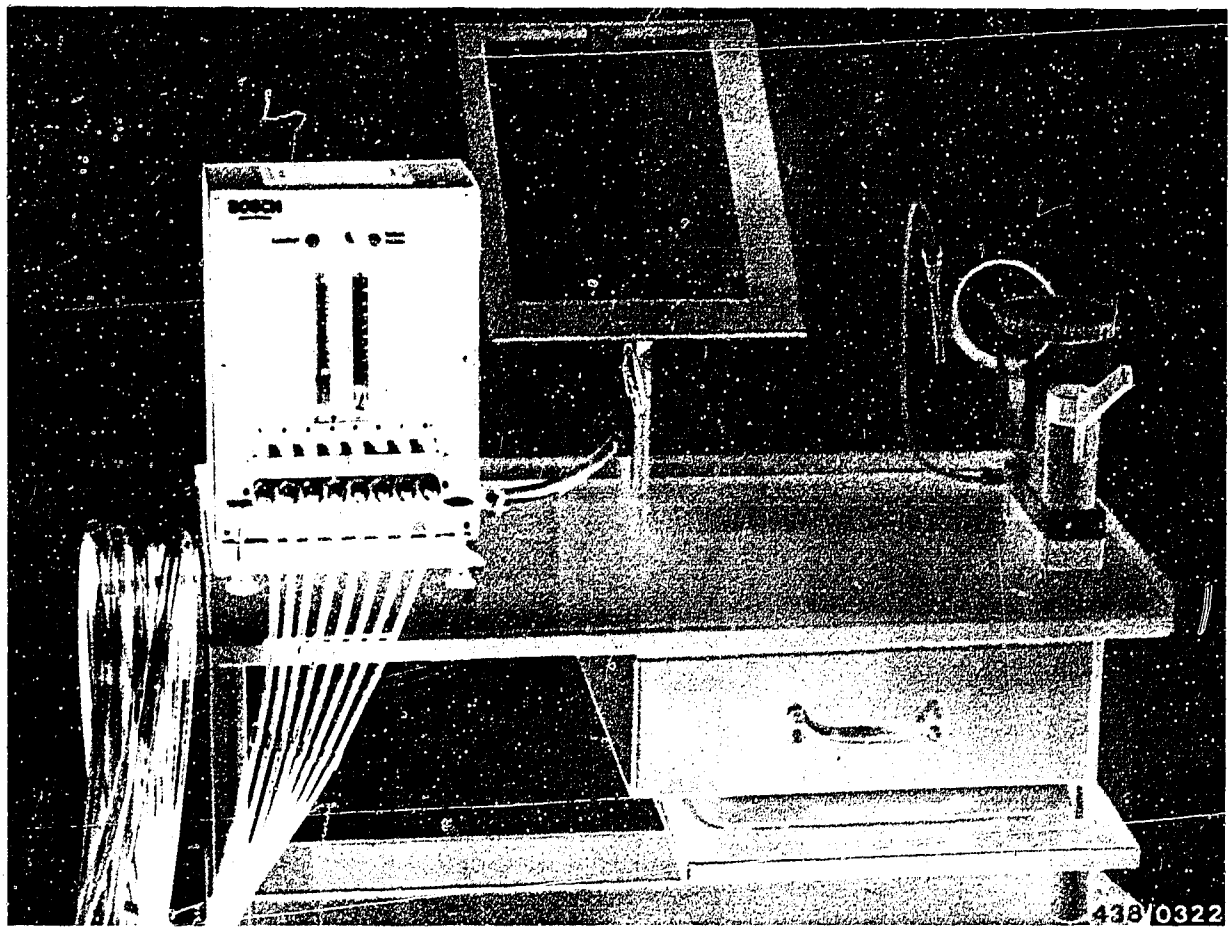
438/0062

Poor spray formation; replace injection valves.

Illustration shows "spray in strands".

If defective injection valves have been replaced, it is necessary finally to adjust the idle speed with the engine at normal operating temperature.

Idle-speed adjustment is described on Coordinates F

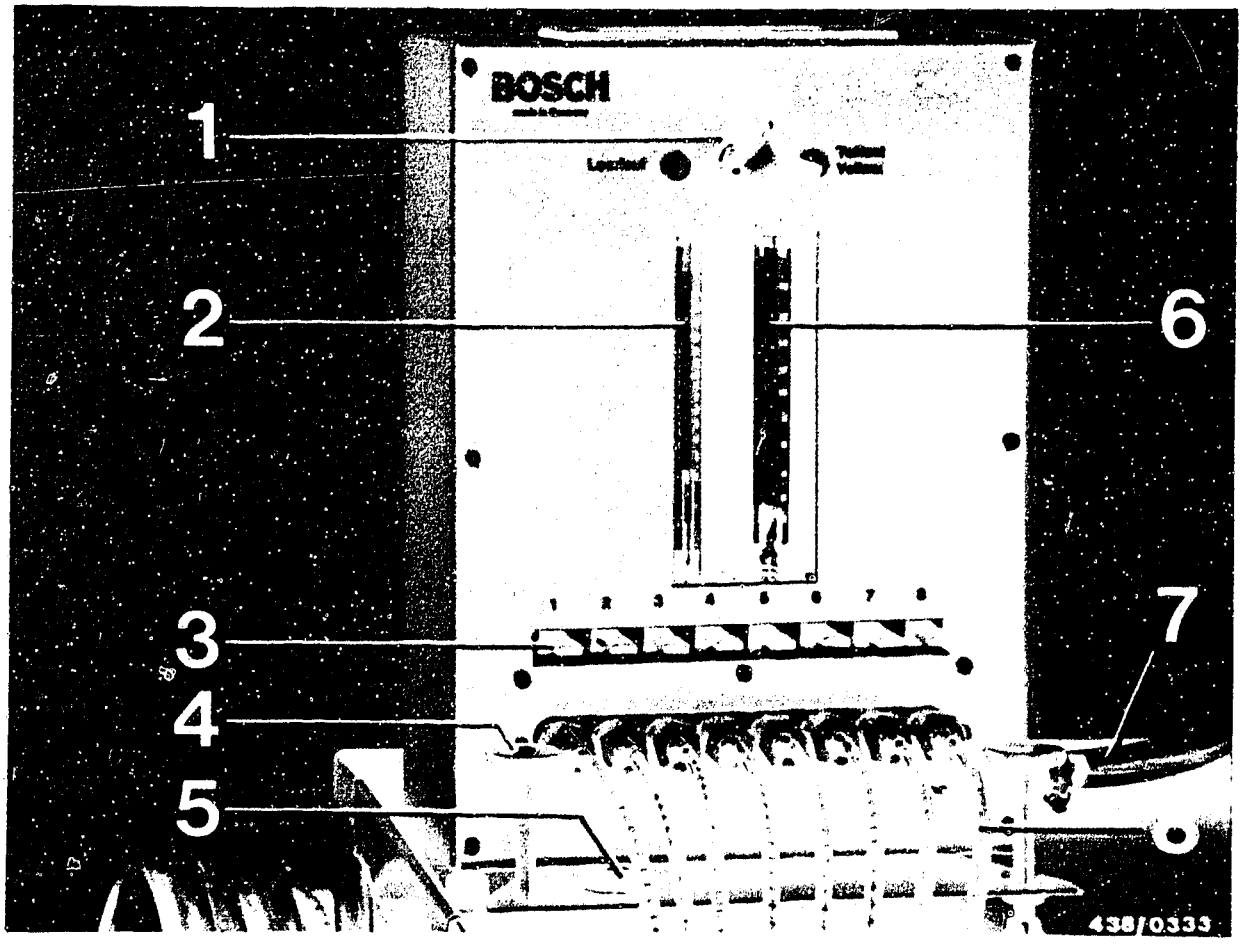


18. Comparative measurement of fuel delivery of fuel distributor outlets.

This test is carried out using the tester for delivered quantity comparison KDJE-P 200 (previously KDJE 7451).

18.1 Application

By means of comparative measurements, the differences in the amounts of fuel delivered from the individual outlets on the fuel distributor are determined.
The tester is designed so that the test can be made on the vehicle without having to remove the fuel distributor.
Since the test is made with the original injection valves, the operator can recognize at the same time whether delivered-quantity scatter, if it occurs, is caused by the fuel distributor or by the injection valves.



1 = 3-way cock
2 = Small rotameter tube
3 = Keyboard for 8-way valve
4 = Adjusting screw for setting up
5 = Spirit level
6 = Large rotameter tube
7 = Return hose
8 = Polyamide hose lines (test lines)

18.2 Construction

The tester is designed for use with all engines, up to 8 cylinders, equipped with K-Jetronic.

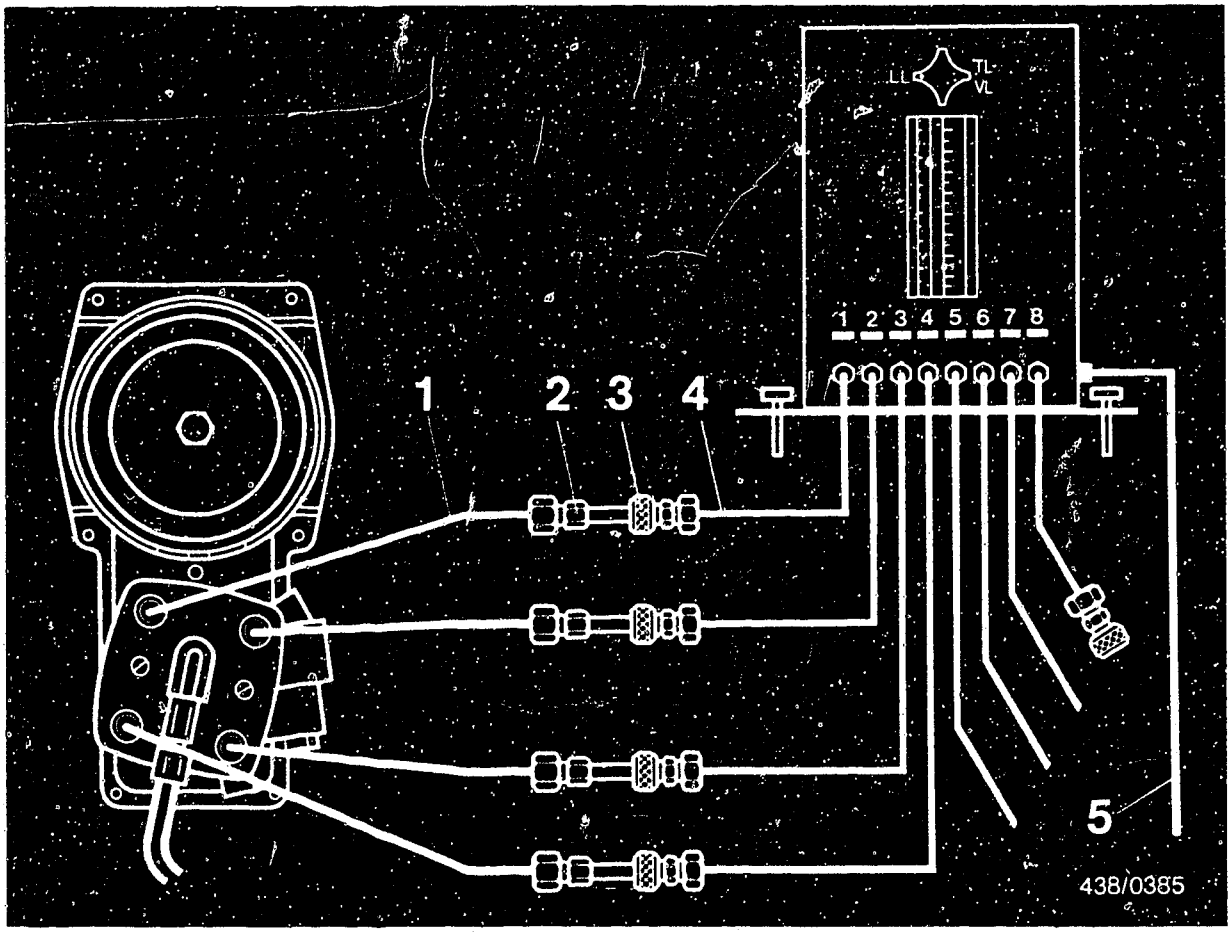
Basically, the tester consists of a steel housing containing 2 rotameter tubes with measuring ranges of 2...15 cm^3 and 10...180 cm^3, an 8-way valve for key operation (Item 3) and a 3-way stopcock (Item 1).

The small rotameter tube (Item 2) is used for the idle measurement while the large tube (Item 6) is used to measure the fuel delivery at part- and full-load. The particular rotameter tube to be used is connected by means of the 3-way stopcock. Using the 8-way valve, the fuel delivery of each cylinder is tested one after the other.

Attached to the tester are 8 hoses (Item 8), each terminated with an automatic connector. When the injection valves are withdrawn from their sockets on the engine they are attached to these connectors. Each automatic connector is fitted with a push valve so that no fuel can escape from connectors that are not in use (when 4- or 6-cylinder systems are tested).

The fuel is returned to the fuel tank through a hose (Item 7) about 5 m long.

The entire test is made with a closed circuit, i.e. no fuel escapes.



1 = Fuel distributor injection tubing
2 = Injection valves
3 = Automatic connectors
4 = Tester hoses
5 = Return line to fuel tank filler neck

18.3 Setting up and connecting the tester:

Set the tester up beside the engine on a solid base (e.g. on tester trolley KDJE-W 100) and align it with the built-in spirit level at the base of the tester.

Remove injection valves; the injection tubing remains connected.
Clean the injection valves with a rag and insert injection valves in correct sequence into the automatic connectors of the first four tester hoses.

Note:
Insert the injection valves as far as they will go and tighten the knurled thumbscrews well so that the non-return valves of the automatic connectors are open fully.
Introduce the return hose of the tester into the fuel tank filler neck.

18.4 Bleeding the tester:

Remove the rubber hood so that air-flow sensor plate becomes accessible.

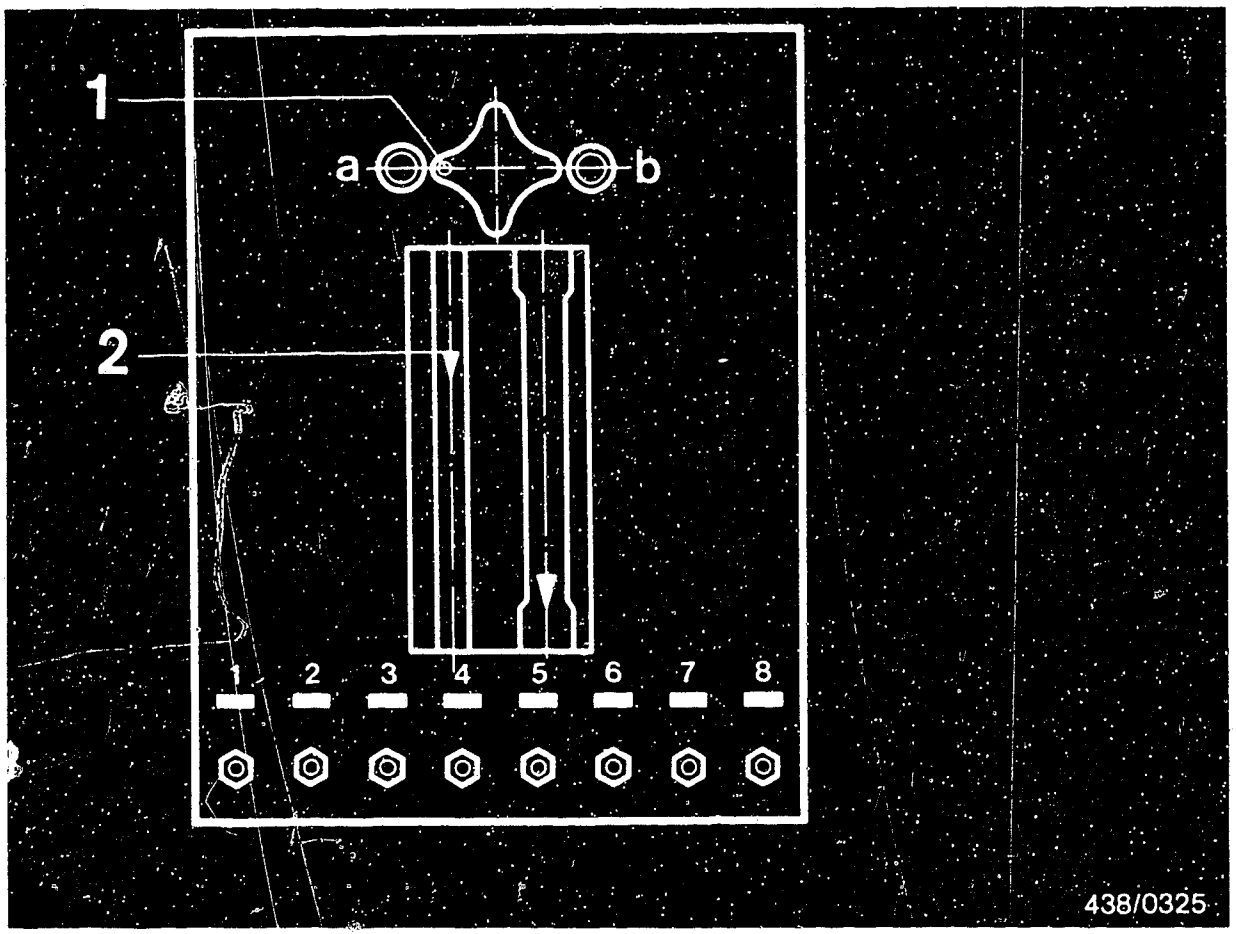
Remove the electric plugs from the warm-up regulator and the auxiliary-air device.

Switch on the electric fuel pump by bridging the electrical safety circuit.

Raise the air-flow sensor plate to the stop.

Press the keys on the 8-way valve one after the other, while simultaneously switching the 3-way stopcock until both rotameter tubes are bled.

Return the sensor plate to the rest position.

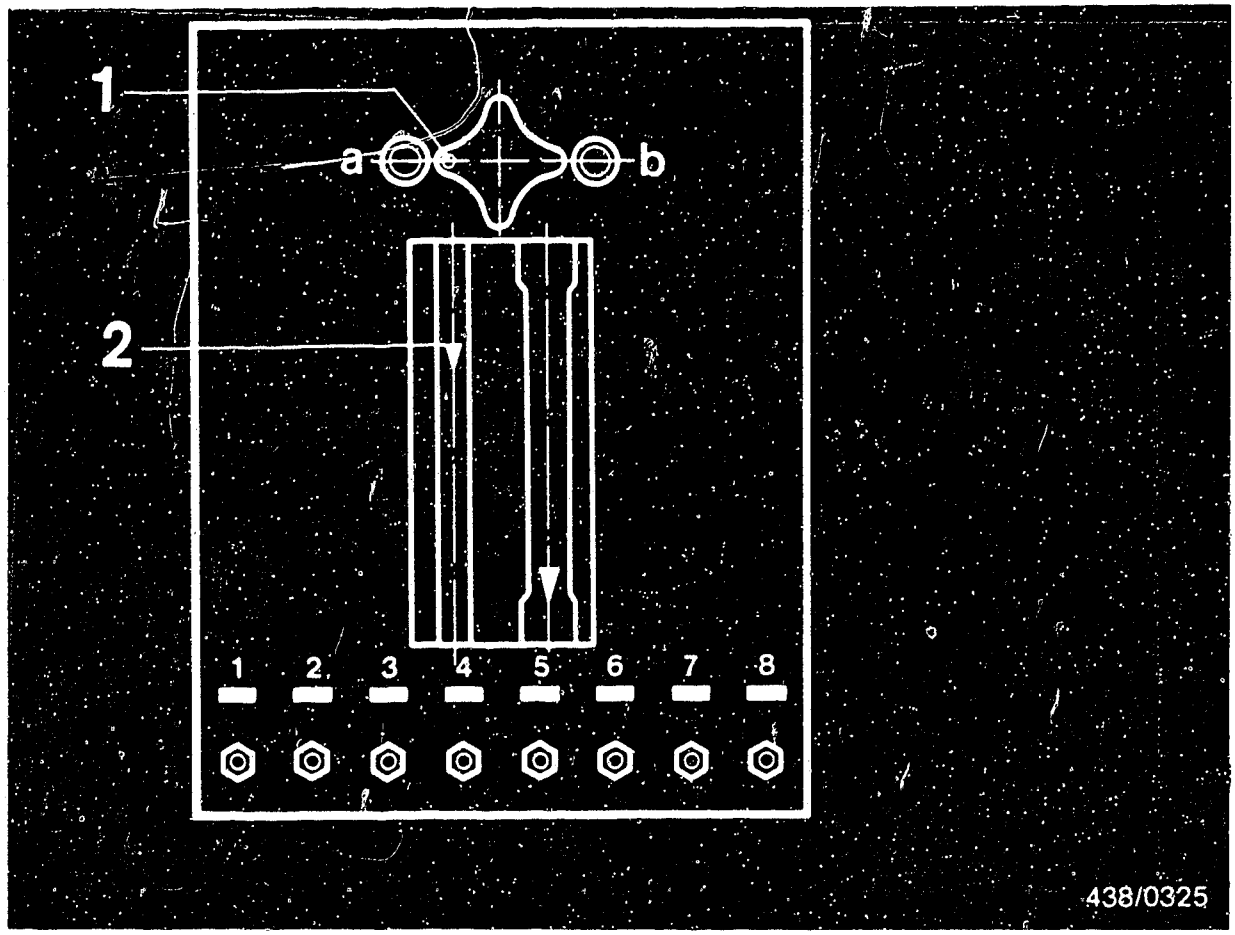


1 = White dot
2 = Measuring line

a = Idle
b = Part load/full load

18.5 Testing

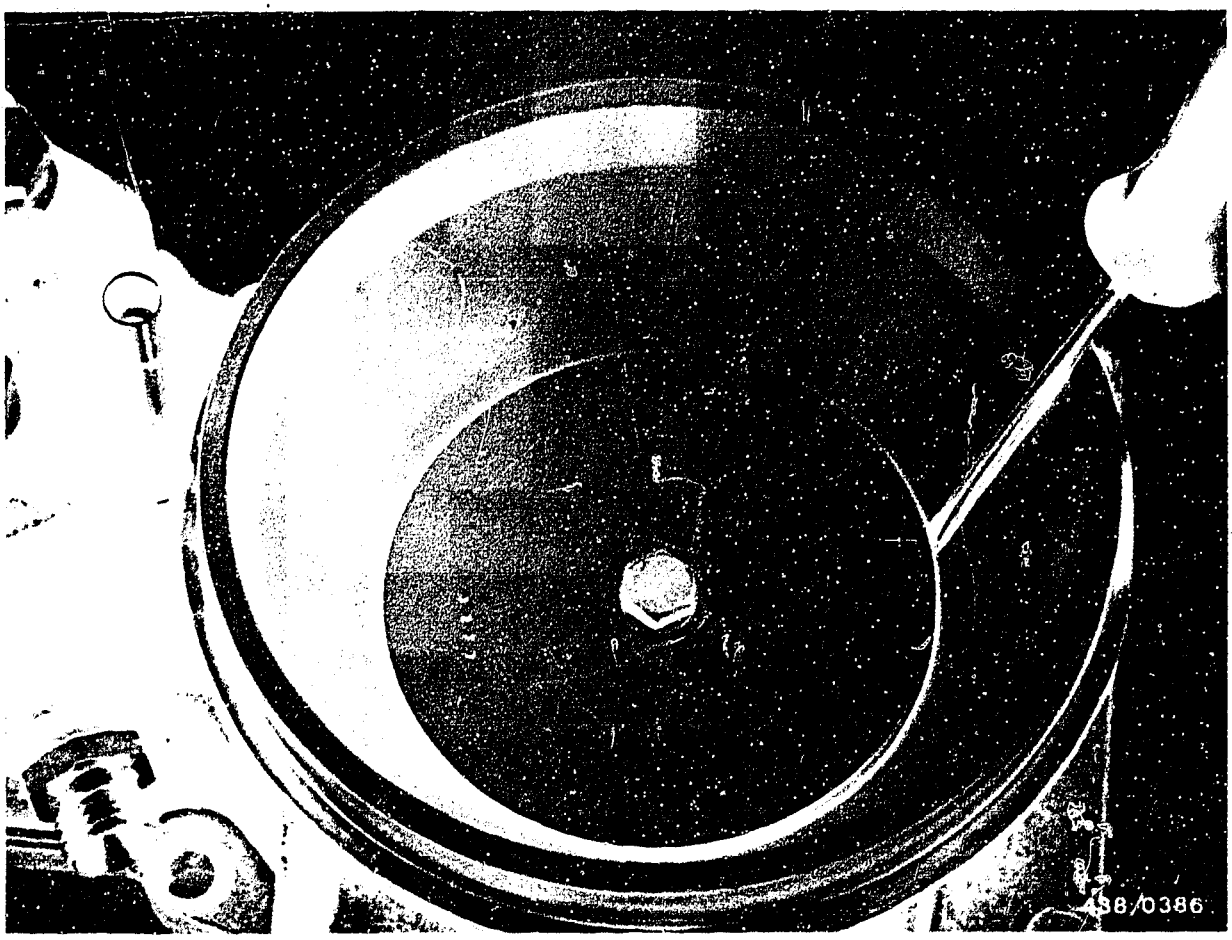
The flow comparison measurement is made in the idle, part-load and full-load ranges.
The small rotameter tube is to be used for the idle measurement (white dot to the left on control knob); part-load and full-load measurements are made using the large rotameter tube (white dot to the right).



1 = White dot
2 = Measuring line

a = Idle
b = Part load/full load

The delivered quantities indicated on the rotameter tubes are read off at the top edge of the conical float (Item 2). On testers with a bail float the uppermost point of the ball is used for reading off. With each measurement be sure to wait until the float has reached its final position. This may take 20 ... 30 seconds in the case of small deliveries.



The exact setting and locating of the position of the air-flow sensor plate for the various load ranges is done using a screwdriver (a small one for the idle position), which is inserted to an appropriate depth between the air funnel and air-flow sensor plate.

Procedure:

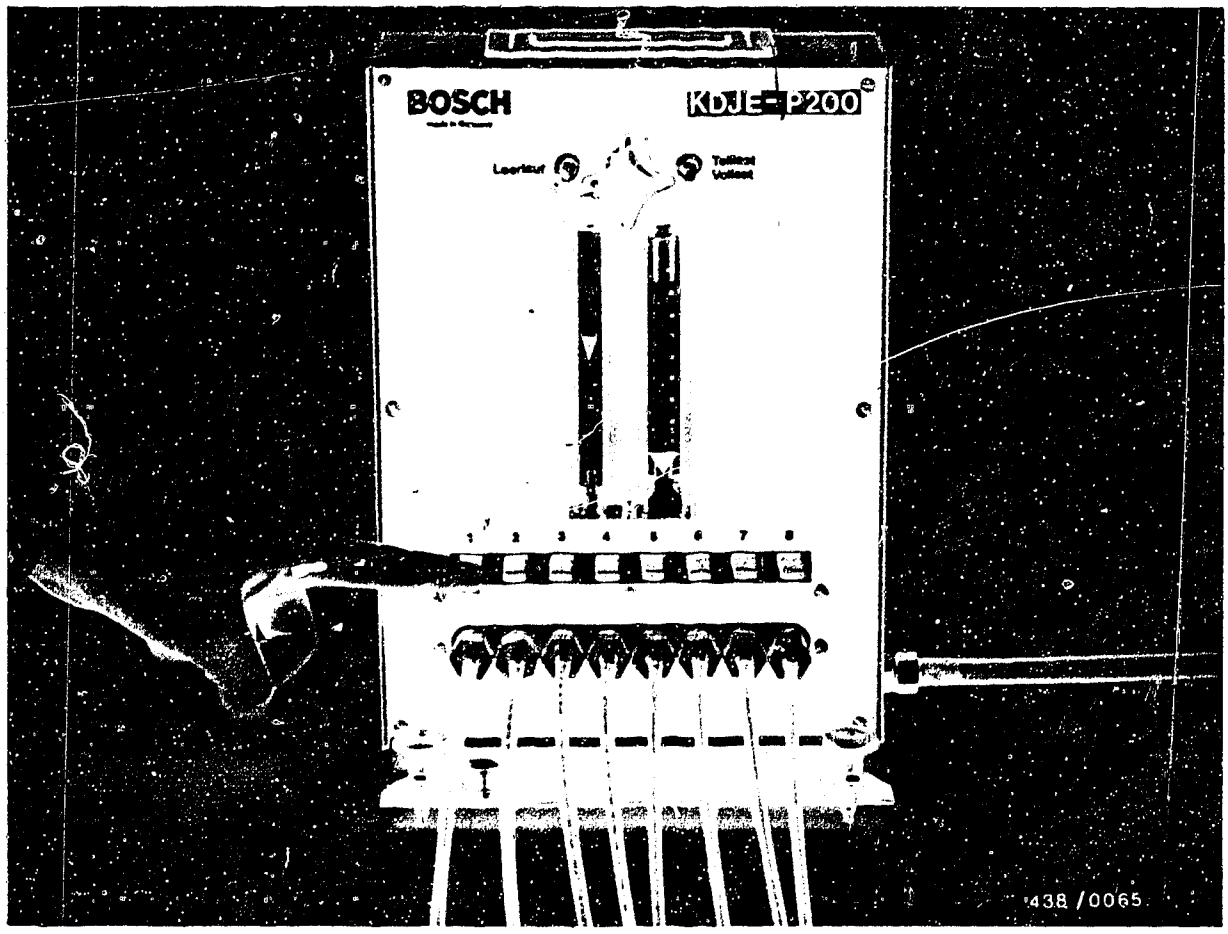
Switch on the electric fuel pump by bridging the electrical safety circuit.

Fixed numerical values are specified in the following test section for the maximum permissible fuel delivery differences for the individual load ranges.

The "setpoint" value always pertains to the fuel-distributor outlet with the lowest fuel delivery, i.e. in each case the outlet with the lowest delivery is to be first ascertained.

Test specifications for fuel distributor 0 438 100 005:

Comparative measurement of deliveries of outlets	Setting point	Max. allowable delivery
Idle	6.0 cm^3/min	6.8 cm^3/min
Part load	40.0 cm^3/min	44.0 cm^3/min
Full load	160.0 cm^3/min	175.0 cm^3/min



Press the key for outlet 1. Pivot the air-flow sensor plate until the corresponding rotameter tube approximately indicates the "set point" value. Fix the air-flow sensor plate in this position.

Test the remaining outlets in order to determine which outlet has the lowest fuel delivery.

Press the key for this outlet again, and set the delivery precisely to the "set point" by correcting the position of the air-flow sensor plate. Then fix the air-flow sensor plate in this position again.

Press the remaining keys one after the other, and determine the maximum fuel delivery of each outlet. A deviation in fuel delivery can only be above the "set point".

If, in testing, a too large difference is ascertained in one of the three load ranges, the test should for safety's sake be repeated.

If the result is confirmed, you should check whether the fault lies in the fuel distributor or in the injection valves.

To do this interchange the injection valves with the greatest and smallest difference.

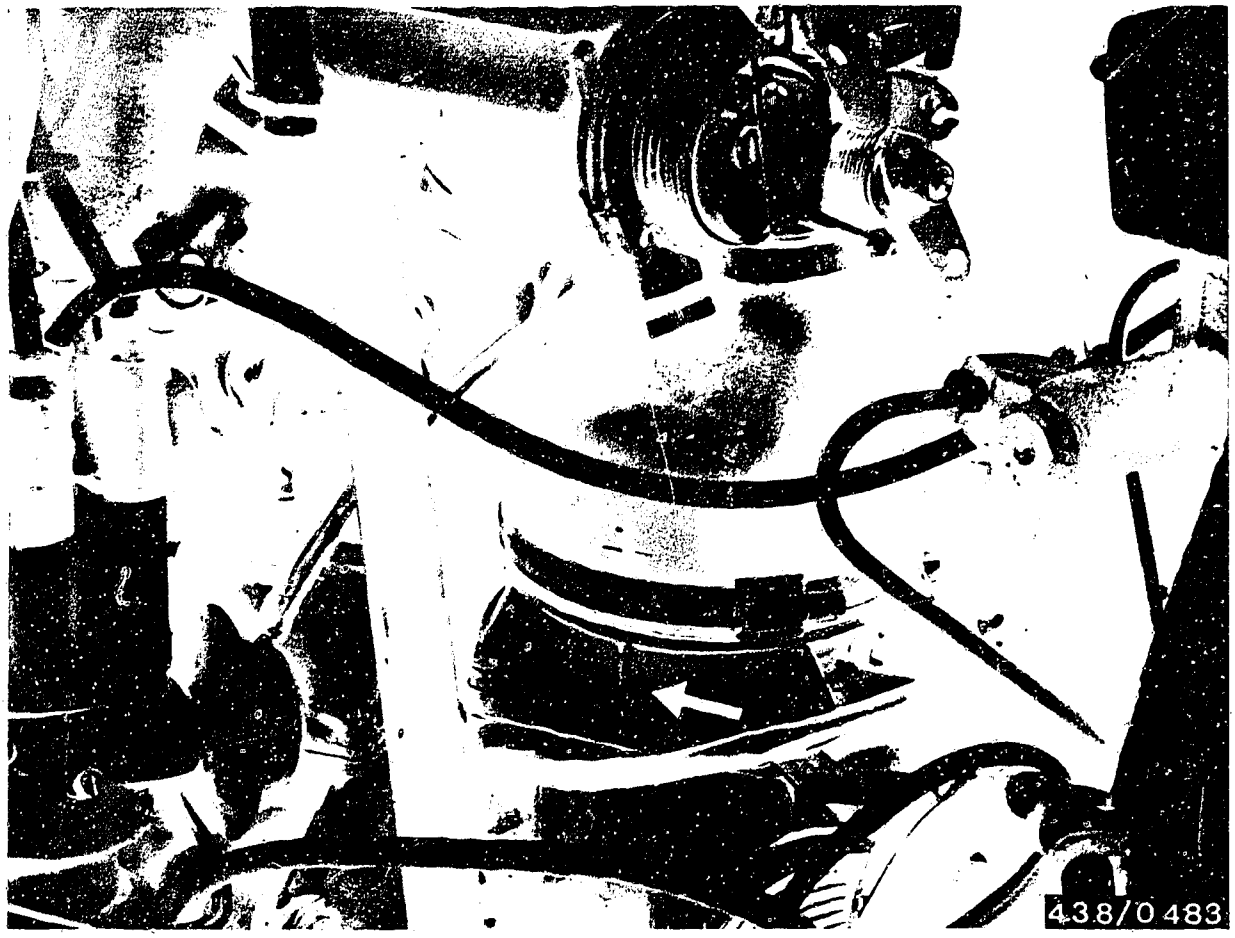
If the result is still the same, the fault is in the fuel distributor. If the fault follows the interchanged injection valves, it lies in the injection valves.

Change defective fuel distributor and/or replace defective injection valves.

18.6 Final operations:

Check the seal rings on the stem of the injection valves for damage and deformation. If necessary, use new seal rings (Volvo service part).

Install the injection valves and connect the injection lines.



Install the connection dome between air-flow sensor and throttle-valve assembly. Make sure that the arrow on the connection dome points to the reinforcing rib in the air-flow sensor housing (arrow).

Re-connect the electrical safety circuit of the K-Jetronic. Ensure this is done properly.

Finally, carry out the idle adjustment with the engine at normal operating temperature.
Idle adjustment is described on Coordinate F 1 .

19. Idle adjustment

19.1 Test conditions:

Warm the engine up for the idle adjustment (oil temperature approx. 80°C).

Important note:

If injection lines or injection valves have been loosened or removed, warm the engine up under load. The low fuel throughput at idle is not always sufficient to drive all the air out of the injection lines.

The idle adjustment must not be performed when the engine is too hot, e.g. immediately after being raced or after a power measurement on the chassis dynamometer.

In vehicles with an air conditioner, this should be switched off in order to stabilize the engine speed for the idle adjustment.

Measure the engine speed with a separate tachometer.

Check whether the throttle lever is up against the idle stop. The cable must be set free of tension.

19.2 Test specifications for idle adjustment

Idle speed: 900 min^{-1}

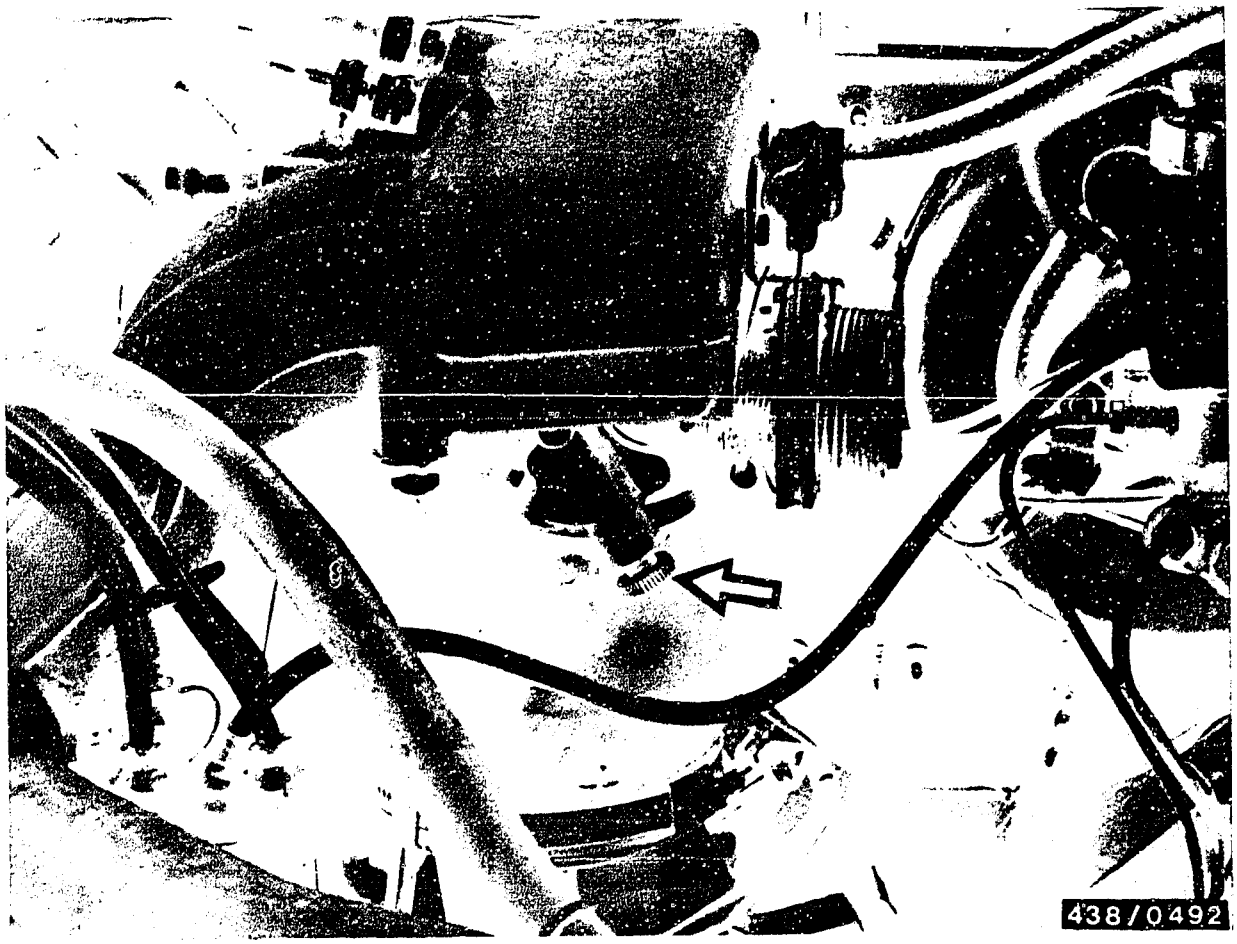
CO concentration (% by vol.)*

Checking value: 1.0...3.0 %

Setting value: 2.0 %

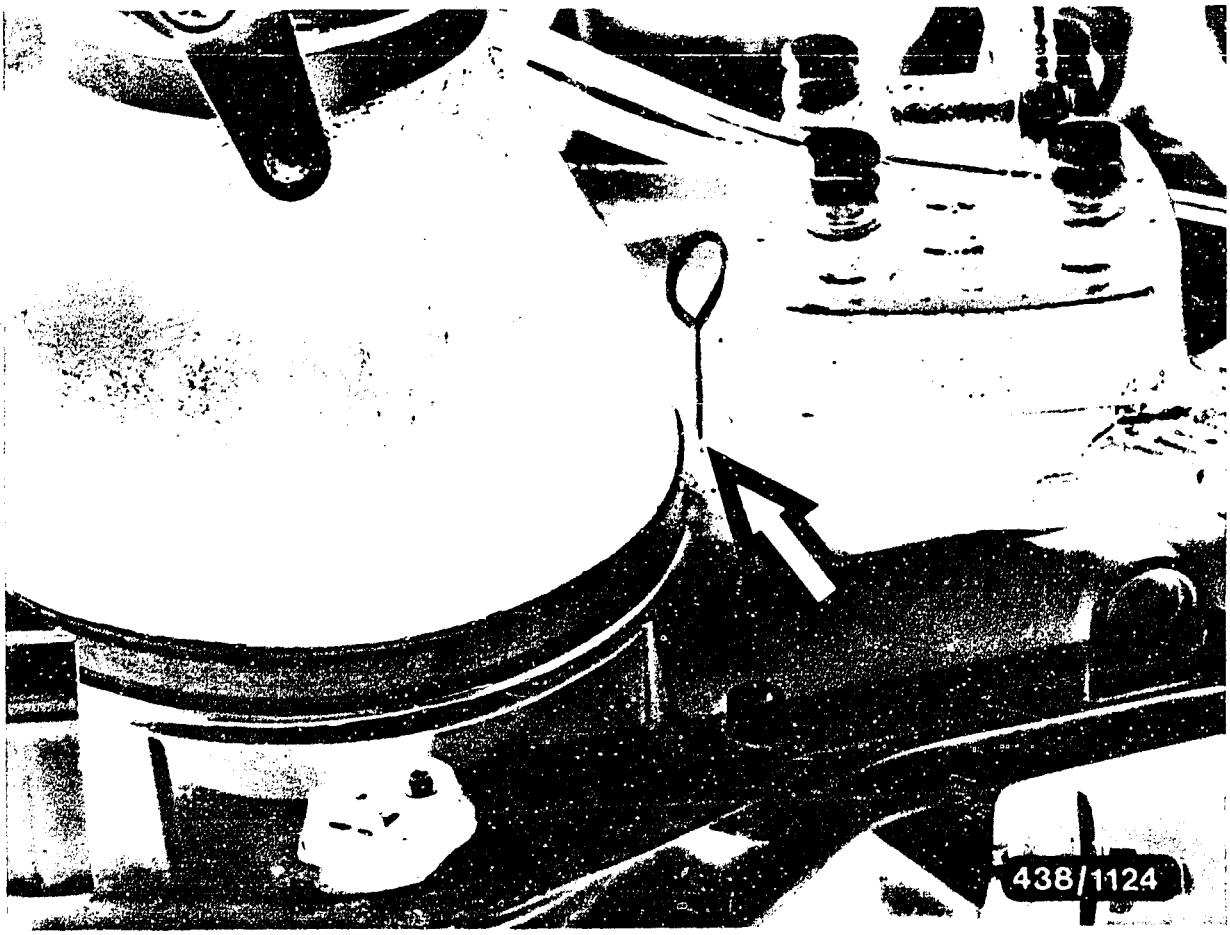
* Readjust the CO according to "setting value"

Engines whose CO concentration is within the checking tolerance need not be readjusted if otherwise running smoothly.



19.3 Adjusting

Adjust the idle speed at the bypass screw on the throttle-valve assembly (arrow).



Adjust the CO concentration by turning the idle-mixture-adjusting screw in the air-flow sensor with the aid of adjusting wrench KDEP 1035.

After removing the rubber plug (arrow), the wrench is inserted through the bore between fuel distributor and air funnel into the idle-mixture-adjusting screw in the control lever.

Turning in a clockwise direction enrich s the mixture

Turning in a counterclockwise direction leans the mixture

Caution:
Always make the adjustment from the lean side, i.e. if the mixture is too rich turn the idle-mixture-adjusting screw further to the left than necessary and then turn it to the right up to the setting required.

After every adjustment remove the adjusting wrench and accelerate the engine briefly, so that the air-intake system can cool off. Then wait until the indicator of the CO tester has stabilized. Never accelerate the engine with the wrench still in place as this could result in bending the control lever in the air-flow sensor.

After-sales Service

Technical Bulletin

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Continuous Injection System mixture control-unit

VDT-I-438/100 B

Ed. 2 7.1975
Translation of German edition of 1.7.1975

The mixture control unit is still being reported as one defective unit in warranty claims. We wish to point out expressly that the mixture control unit consists of two separate products, the air-flow sensor and the fuel distributor, and that there are separate defect numbers for them in the warranty manual. Please report only the defective product.

Accessory Sets

Various fuel distributors and warm-up regulators have been supplied up to now with pressed-in plug connectors. These will no longer be supplied in future.

	no longer available	Replacement + accessory set
Fuel distributor	0 438 100 002	0 438 100 017
	0 438 100 003	0 438 100 005 + 2 437 001 001
	0 438 100 004	0 438 100 017
Warm-up regulator	0 438 140 002	0 438 140 004 + 1 437 000 000

The accessory sets contain the required number of tailpieces and seal rings.

Please note: the accessory set 2 437 001 000 is delivered included with the fuel distributor 0 438 100 017, and does not therefore need to be ordered separately.

Electric Fuel Pump

In the Technische Mitteilung VDT-BMO 114/1 B and the Service Information sheet VDT-I-740/2-1 B 1st. supplement, we announced that the non-return valve can be replaced on the electric fuel pump 0 580 254 996. We have come to the conclusion from the warranty claims that not enough use is being made of this possibility. Please bear this fact in mind and repair leaky electric fuel pumps before deciding to replace the entire assembly.

In case of inquiry, please contact your authorized representative.

ROBERT BOSCH GMBH
Geschäftsbereich KH
Kundendienst - Technik

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Packaging of goods under warranty

438

K-Jetronic (CIS)

VDT-I-438/101 B
10. 1976

All components or assemblies of the K-Jetronic which are dispatched under warranty must be correctly and carefully packaged so that no further damage or impairments occur during transit, since these would not be covered by warranty.

Any fuel remnants must be removed from those K-Jetronic assemblies intended for dispatch, so as to eliminate any danger of fire during transit.

The intake openings and outlets of the assemblies must be sealed off with caps or plugs. As new products were fitted, the caps or plugs from these may be used.

The plunger of the fuel distributor is to be fitted with a protective cap of adequate size, or secured to the fuel distributor.

In addition, the assemblies are packed in tightly packed, well-sealed plastic sleeves. Fuel distributors and warm-up regulators are packed individually.

If components arrive damaged due to incorrect packaging or do not comply with these instructions, they can be returned and the warranty claim rejected.

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EXCHANGEABLE NON-RETURN VALVES
in electric fuel pumps 0 580 254 ..

VDT-I-438/104 En
3.1983
(Replaces Ed. 5.1982)

Electric fuel pump	Parts set (non-return valve + seal ring)	Non-return valve	Seal
0 580 254 001	1 587 010 500	---	---
002	500	---	---
0 580 254 003	502	---	---
004	502	---	---
005	502	---	---
006	502	---	---
007	500	---	---
948	005	---	---
949	002	---	---
950	006	---	---
951	006	---	---
952	002	---	---
953	501	---	---
954	002	---	---
956	002	---	---
957	002	---	---
958	002	---	---
959	002	---	---
960	002	---	---
961	002	---	---
962	002	---	---
963	005	---	---

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Electric fuel pump	Parts set (non-return valve + seal ring)	Non-return valve	Seal ring
0 580 254 964	1 587 010 002	---	---
965	002	---	---
966	002	---	---
967	002	---	---
968	002	---	---
969	002	---	---
970	002	---	---
971	002	---	---
972	002	---	---
973	002	---	---
974	002	---	---
975	003 ④	---	---
976	004 ③	---	---
977	004 ③	---	---
978	1 587 410 901	---	---
979	010 004 ③	---	---
980	002	---	---
981	002	---	---
982 ①	003 ④	---	---
982 ②	1 587 410 901	---	---
984	010 004 ③	---	---
985	---	1 583 385 006	1 580 203 002
986	---	386 011	001
987	---	008	001
988	---	008	001
989	---	008	001
990	---	385 004	002
991	---	004	002
992	1 587 010 001	---	---
996	---	386 011	001
998	---	385 004	002
9 580 234 003	002	---	---
005	002	---	---

1 = up to FD 822 2 = from FD 823

3 = Parts set ..003 also possible (delivery-line connection at 90°)

4 = Parts set ..004 also possible (delivery-line connection axial)

After-sales Service

Technical Bulletin

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HOT-STARTING PROBLEMS

438

VDT-J-438/105 En
3.1980
Replaces Ed. 2.1980

K-Jetronic

Hot-starting problems can occur in various vehicles fitted with K-Jetronic. This means that when an engine is switched off whilst still hot and then switched on again after a short period, it does not start as well as it should.

The engine, the ignition system and the K-Jetronic system in these vehicles should be carefully checked. With the K-Jetronic particular attention should be paid to the:

complete system (in case of leaks),
injection valves (in case of leaks),
correct position of the air-flow sensor plate (rest position).

Instructions can be found in the vehicle-related repair manuals VDT-W-438/5.. .

If the engine still does not start satisfactorily when hot, even after checking, a timing relay can be fitted in K-Jetronic systems which are not equipped with a solenoid valve for reducing the control pressure as additional starting help.

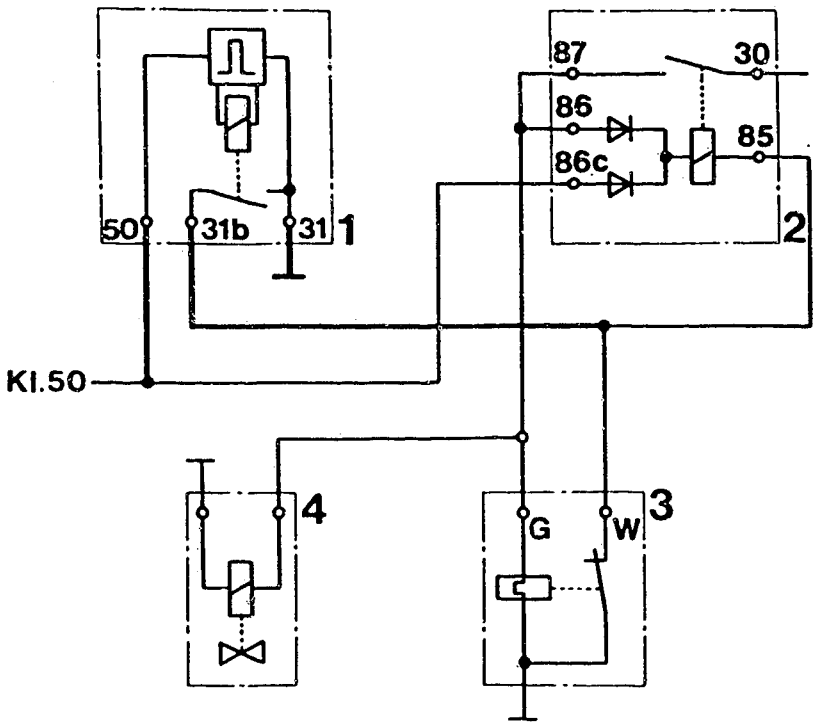
Timing relay 0 340 000 003 controls the start valve during hot starts. The start valve then injects extra fuel intermittently (sometimes cutting out completely.

The timing valve is fitted according to the wiring diagram (see reverse side). The fitting of this relay will be charged for.

After fitting the timing relay starting should be carried out as follows:

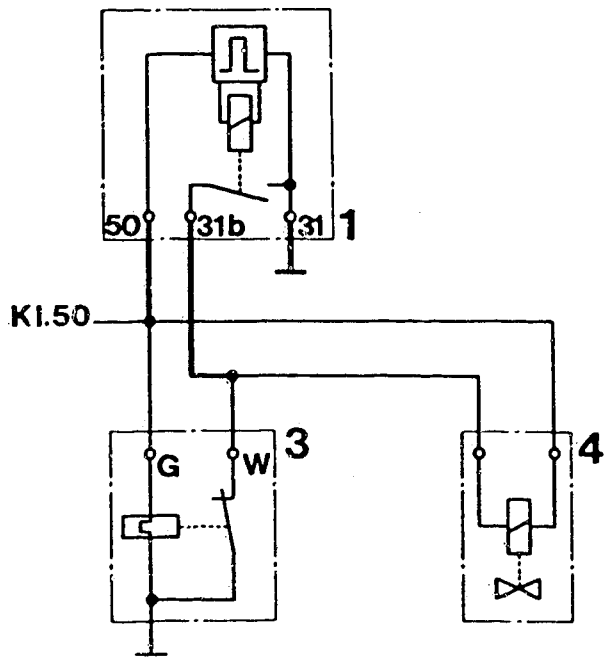
Vehicles with start valve in intake manifold - with open throttle valve,
Vehicles with start valve in idle duct - with closed throttle valve.

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K-Jetronic system with post-injection relay

1 = Timing relay 0 340 000 003
2 = Post-injection relay
3 = Thermo-time switch
4 = Start valve



K-Jetronic system without post-injection relay

After-sales Service

Motor Vehicle Service Information

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HOT-STARTING PROBLEMS

on vehicles fitted with Jetronic

VDT-I-Gen. 050 En
9.1982

Customer complaints

If the vehicle is parked and the engine switched off after having been run at normal operating temperature, it often occurs that the engine proves difficult to start, or won't start at all, and when it does start it runs extremely roughly (only on 2 or 3 cylinders). The engine has to be accelerated a number of times before it runs smoothly.

Causes

For economic reasons ("stretching" of the mineral-oil reserves), it can happen that alcohol in varying quantities has been added to gasoline. Methanol is used for instance.
Such alcohol-added fuels, depending upon the amount of alcohol, adversely affect the hot-starting characteristics of the engine. The addition of alcohol raises the vapor pressure of the fuel and the result is that the boiling point of the alcohol-fuel mixture drops. This in turn leads to the formation of fuel-vapor locks in the fuel system when the engine has been switched off.

This means that when starting, and during the subsequent idle period, the air-fuel mixture is temporarily too lean.

Remedies

- Check the ignition and Jetronic systems, particularly for leaks.
- Changing to another brand of gasoline can sometimes cure the problem immediately.
- In many cases, fully depressing the gas pedal helps during starting, as does slightly depressing the gas pedal during the idle period until the engine runs smoothly.
- Fit the pulse relay 0 340 000 003 (refer also to VDT-I-438/105) in vehicles with K and D-Jetronic.
 This step, though, will still not fully alleviate the rough running of the engine during the starting off phase

Note:

The pulse relay 0 340 000 003 is NOT to be installed in vehicles fitted with L-Jetronic.

Please direct questions and comments concerning the contents to our authorized representative in your country.

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COLD START - WARM UP
ACCELERATION PROBLEMS

VDT-I-Gen. 051 En
10.1982

in vehicles with Jetronic

Customer complaints

- Starting problems with a cold engine
- Engine bucking during warm up
- Uneven idle (speed fluctuations)
- Engine cuts out during acceleration (flat spot)
- Loss of output

Cause

When the ignition and the Jetronic have been checked and the test specifications given have been reached, a possible reason for the problems quoted could be coke residue on the intake valves.

The carbon residue thus present delays a continuous flow of fuel from the injection valve to the combustion chamber on account of its sponge effect.

As a result of this the air-fuel mixture can in some cases be so lean, that it can no longer be ignited.

Loss of output results from a reduction in the amount of cylinder filling and is caused by a very high coking.

Complex connections between qualities specific to the engine, the engine oil and fuel used, as well as relevant driving cycles (e.g. mainly short stretches) can cause such coking on the intake valves.

Remedy

Dismantle the intake valves and remove the deposits.

Please note

Various vehicle manufacturers are working at the moment on other measures, such as cleaning with additives. Results of these tests are not yet available.

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LIQUID PETROLEUM GAS (AUTOGAS) SYSTEMS AND VEHICLES WITH K-JETRONIC

VDT-I-Gen. 052 En
10.1982

Fitting at a later stage

Vehicles with K or L-Jetronic are not suitable for fitting at a later stage with liquid petroleum gas (LPG) systems.

Numerous problems can occur, such as:

- Reduction of fuel flow through the injection valves due to deposits
- Stiffness or blocking of the K-Jetronic fuel distributor plunger (due to gumming or similar) in the course of time with "gas only operation."
- Increased danger of backfiring in the intake manifold (burbling) and thereby damage to the air-flow sensor.

Guarantee

Guarantee claims for failed Jetronic components from vehicles thus converted will not be accepted.

Conversion to liquid gas operation is made at the risk of the vehicle owner.

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